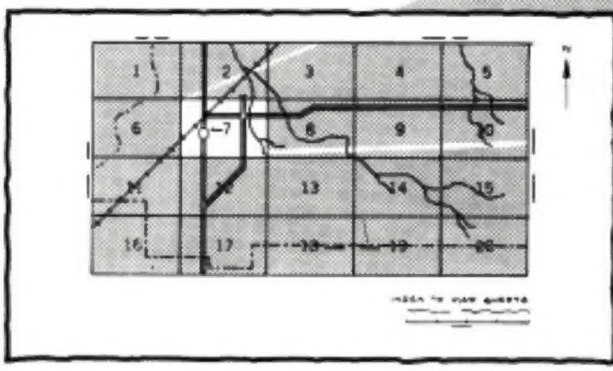
SOIL SURVEY OF

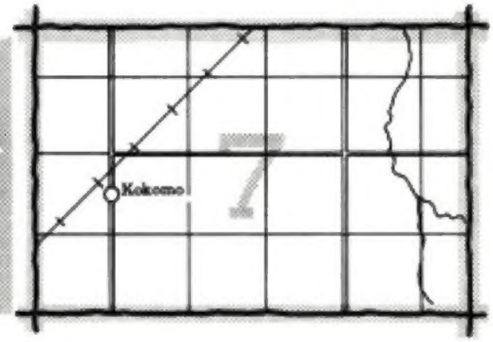
HUNT COUNTY, TEXAS

United States Department of Agriculture, Soil Conservation Service
in cooperation with Texas Agricultural Experiment Station

HOW TO USE

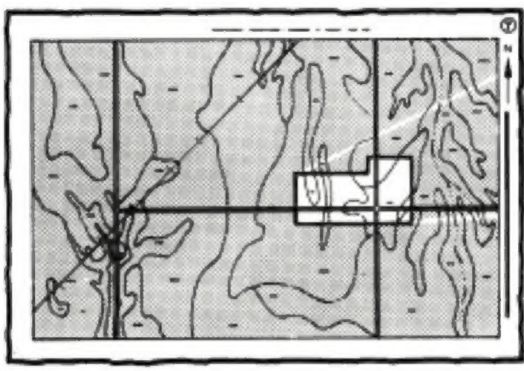
1. Locate your area of interest on the "Index to Map Sheets"

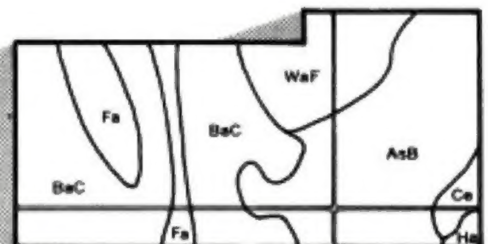




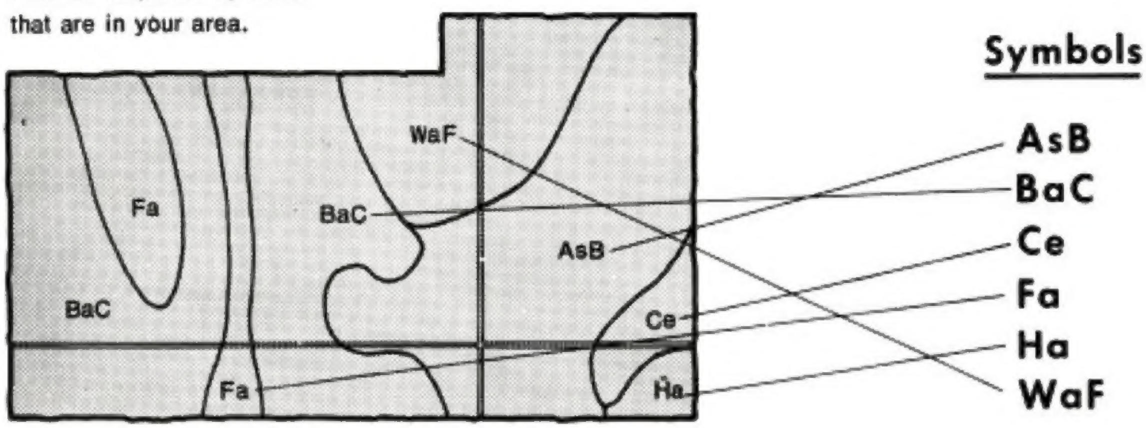
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



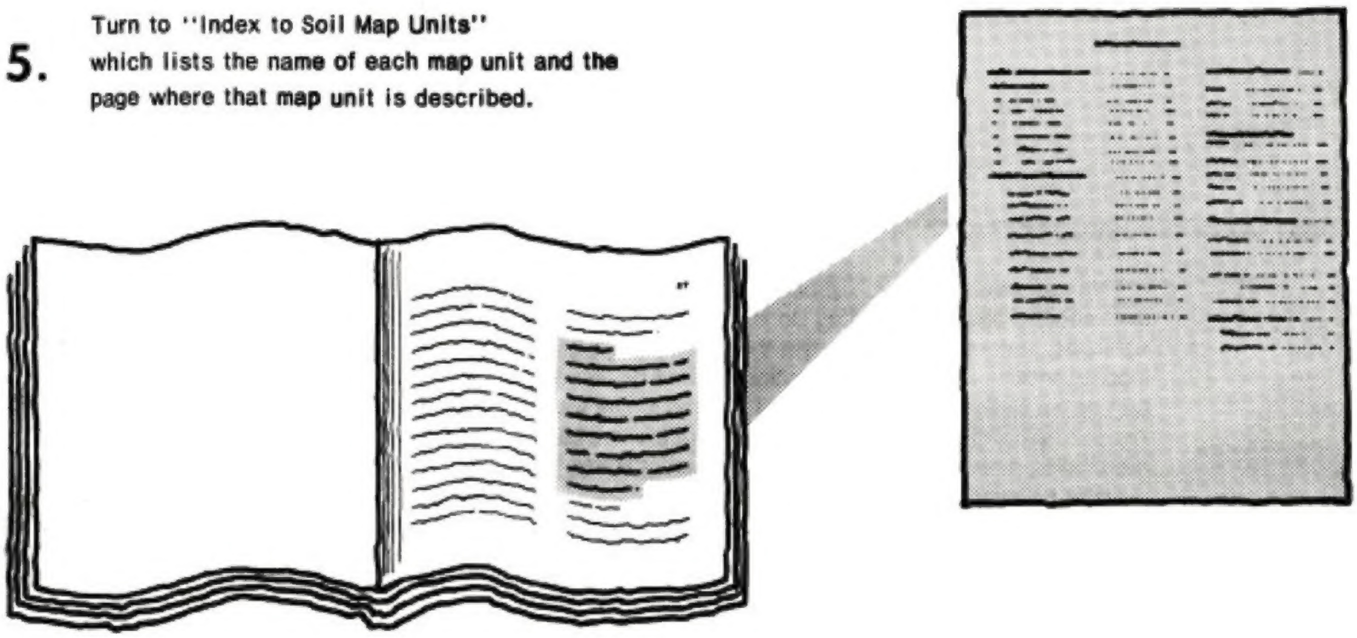


4. List the map unit symbols that are in your area.

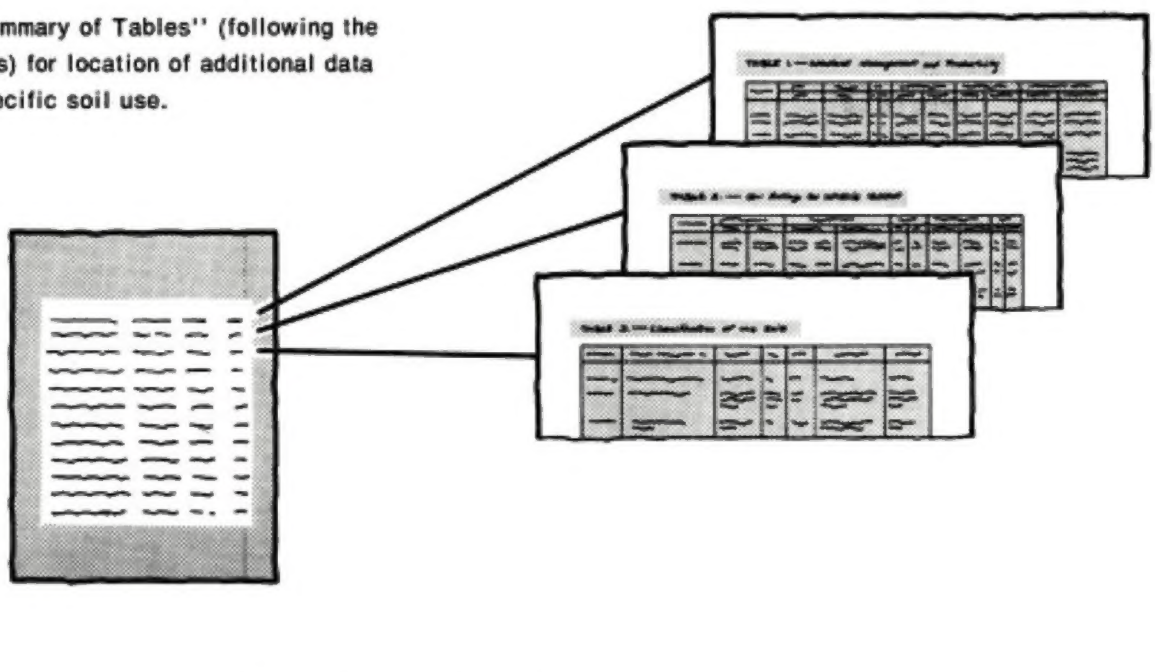


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1972 to 1977. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Upper Sabine Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This soil survey supersedes a soil survey of Hunt County published in 1939.

Cover: Field of cotton, with terraces and grassed waterways, on Houston Black clay, 1 to 3 percent slopes.

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foreword

This soil survey contains information that can be used in land-planning programs in Hunt County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks

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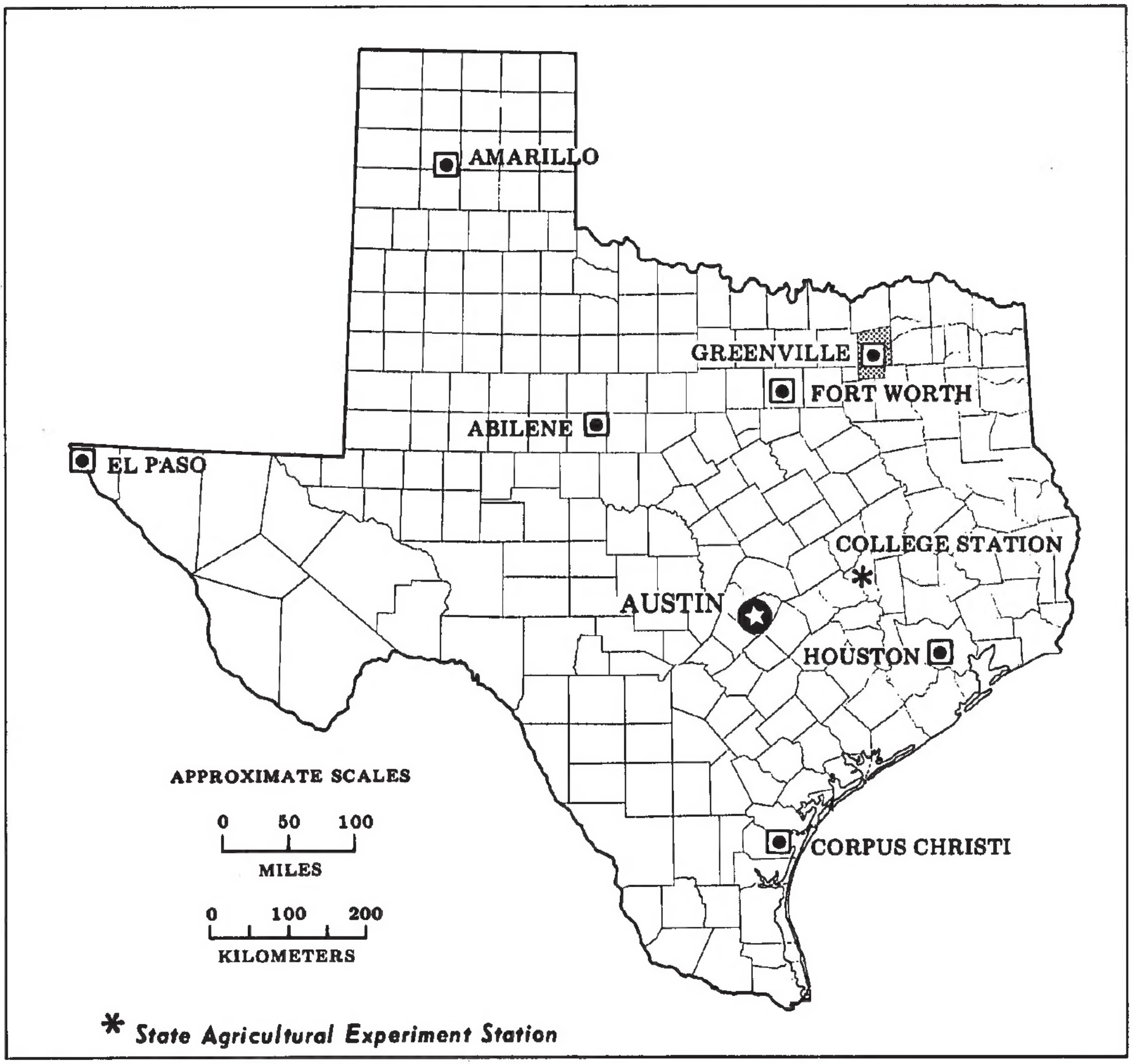
State Conservationist
Soil Conservation Service



Location of Hunt County in Texas.

soil survey of
Hunt County, Texas

By Gaylon L. Lane and Edward F. Janak, Jr., Soil Conservation Service

Fieldwork by Gaylon L. Lane, Bobby J. Ward, Fred B. Pringle
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United States Department of Agriculture, Soil Conservation Service
in cooperation with the Texas Agricultural Experiment Station

HUNT COUNTY is in the northeastern part of Texas. The county is rectangular in shape, measuring about 37 miles from north to south and 25 miles from east to west. It covers 911 square miles, or 583,040 acres. Greenville is the county seat.

In 1970, the population of the county was 47,948. In 1977, the population was estimated to be more than 50,000. It has been increasing steadily.

About 51 percent of the county is cropland, 31 percent is pastureland, 8 percent is noncommercial woodland, 5 percent is urban or built-up land, and 5 percent is water areas (*3*). Most of the water areas are part of Lake Tawakoni. Production of cotton, grain sorghum, small grains, and beef cattle are the principal farming enterprises. Greenville has numerous small industries and agribusinesses.

general nature of the survey area

This section gives general information on the climate, history, and land and water resources of the county.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Greenville in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 44 degrees F, and the average daily minimum temperature is 33 degrees. The lowest temperature on record, which occurred at Greenville on February 2, 1951, is 0 degrees. In summer the average temperature is 82 degrees, and the average daily maximum temperature is 93 degrees. The highest recorded temperature, which occurred on July 25, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 43 inches. Of this, 23 inches, or 54 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 5.7 inches at Greenville on September 6, 1973. Thunderstorms occur on about 18 days each year, and most occur in spring.

Average seasonal snowfall is 2 inches. The greatest snow depth at any one time during the period of record was 6 inches. On an average of 1 day, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

history

Hunt County was formed from Fannin and Nacogdoches Counties. The act establishing Hunt County was signed by the first Governor of Texas, J. Pinckney Henderson, on April 11, 1846. The county was named for Memucan Hunt, who was prominent in early Texas history. It was reduced to its present size in 1870 when a part was taken by Rains County.

Greenville, the county seat, was established on a 160-acre site donated by McQuinney Howell Wright. Greenville became an incorporated town by an act of the State Legislature on February 14, 1852. It is now the largest city in the county.

land and water resources

Most of Hunt County is within the Blackland Prairie Land Resource Area. Large areas in the eastern and southwestern parts, however, are loamy, isolated oak-timbered sections of the Texas Claypan Land Resource Area. Physiographically, the county is part of a smooth vast plain where long parallel drainageways typically have broad flood plains. The stream valleys are shallow, and the drainage divides are well rounded. The extreme northwestern and most sloping part of the county, an area of about 19,000 acres, is within the drainage basin of the Trinity River. The northeastern part, an area of about 167,000 acres, is within the drainage basin of the Sulphur River. The remaining part is drained by the Sabine River. The elevation ranges from about 450 feet above sea level in the southeastern part to 700 feet in the northwestern part.

Water from wells generally is available only in the loamy, oak-timbered areas in the eastern and southwestern parts of the county and in areas where soils are underlain by chalk in the extreme northern part. All streams cease to flow during extremely dry periods, but even in such periods there are a few stagnant pools in the beds of the larger streams.

Most rural areas of the county obtain water from water corporations. Their water lines are along many of the farm to market roads. Livestock water is provided mainly by earthen dams across small drainageways. Greenville and most of the other small cities obtain water from Lake Tawakoni, which is in the southeastern part of the county and is one of the largest lakes in northeast Texas. Besides being a source of water, the lake serves as a recreation area.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, engineers, planners, developers and builders, home buyers, and others.

This soil survey supersedes the soil survey of Hunt County published in 1939 (*4*). This survey provides additional information and contains larger maps that show the soils in greater detail.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Pasture is areas of improved grasses and legumes grown mainly for livestock. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

The general soil map of Hunt County matches the updated general soil map of Collin County rather than the map in the published soil survey of Collin County.

soil descriptions

The soils in Hunt County make up 3 general soil groups and 10 general soil map units. The land area of the units makes up almost 95 percent of the total acreage. Water areas make up about 5 percent.

clayey and loamy soils on uplands

This group of soils makes up about 37 percent of the county. It consists of Leson, Houston Black, Ferris, Heiden, Fairlie, and Dalco soils. These soils are gently sloping to strongly sloping. Most are clayey throughout. Some have a loamy surface layer. All are well drained to moderately well drained and are very slowly permeable. Large cracks form on the surface of these soils during dry periods.

Most of these soils are used as cropland. The main crops are cotton, wheat, grain sorghum, and oats. The native grasses on these soils are bluestem, eastern gamagrass, indiangrass, switchgrass, paspalum, and panicum.

The soils in this group have low potential for most urban and recreation uses. The main limitations are high shrink-swell potential, very slow permeability, and clayey surface texture.

1. Leson-Houston Black

Clayey, deep, gently sloping, moderately well drained soils

This map unit consists of soils that have slopes of 1 to 5 percent. It makes up about 30 percent of the county. Leson soils make up about 33 percent of this map unit, Houston Black soils make up 26 percent, and other soils make up 41 percent.

The Leson soils are gently sloping. They are in broad areas. Typically, the surface layer is mildly alkaline, very dark gray clay about 28 inches thick. Below that, to a depth of 58 inches, the soil is moderately alkaline, dark grayish brown clay. The underlying material to a depth of 72 inches is mottled grayish brown, light gray, and light olive brown shaly clay.

The Houston Black soils are gently sloping. They are in broad areas. Typically, moderately alkaline clay extends to a depth of about 64 inches. It is black and dark gray with brownish mottles. Below that, to a depth of 86 inches, the soil material is moderately alkaline shaly clay.

The other soils included in mapping are Burleson, Branyon, Crockett, Ferris, Heiden, Kaufman, and Wilson soils. The loamy Crockett soils and the clayey Burleson and Branyon soils are in positions on the landscape similar to those of the Leson and Houston Black soils. The loamy Wilson soils are in nearly level to slightly

depressed areas. The clayey Ferris and Heiden soils are on narrow ridgetops and side slopes above drainageways. The clayey Kaufman soils are on the flood plains of streams.

The soils in this unit have high potential for cultivated crops and native grasses. Their potential for improved pasture is high.

Their potential for most urban and recreation uses is low. The main limitations are the shrinking and swelling, the very slow permeability, and the clayey texture.

2. Ferris-Heiden

Clayey, deep, gently sloping to strongly sloping, well drained soils

This map unit consists of soils that have slopes of 2 to 12 percent. It makes up about 6 percent of the county. Ferris soils make up about 40 percent of this map unit, Heiden soils make up 18 percent, and other soils make up 42 percent.

The Ferris soils are strongly sloping. They are on side slopes above drainageways. Typically, the surface layer is moderately alkaline, dark olive gray clay about 6 inches thick. Below that, moderately alkaline, olive clay extends to a depth of 42 inches. The underlying material to a depth of 76 inches is grayish and brownish shale and shaly clay.

The Heiden soils are gently sloping and sloping. They are on narrow ridgetops and side slopes above drainageways. Typically, the surface layer is moderately alkaline, black clay about 18 inches thick. Below that, moderately alkaline, olive gray and olive clay extends to a depth of 42 inches. The underlying material to a depth of 62 inches is brownish shaly clay.

The other soils included in mapping are Crockett, Houston Black, Leson, and Tinn soils. The loamy Crockett soils and the clayey Houston Black and Leson soils are in positions on the landscape similar to those of the Heiden soils. The clayey Tinn soils are on the flood plains of streams.

The soils in this unit are generally not suited to use as cropland because of the slope and the hazard of erosion. Their potential for improved pasture is low, and their potential for native grasses is medium.

Their potential for most urban and recreation uses is low. The main limitations are the shrinking and swelling, the very slow permeability, and the clayey texture.

3. Fairlie-Dalco

Loamy, deep and moderately deep, gently sloping, moderately well drained soils

This map unit consists of soils that have slopes of 1 to 4 percent. It makes up about 1 percent of the county. Fairlie and Dalco soils make up about 51 percent of this map unit, and other soils make up 49 percent.

The Fairlie soils are gently sloping. They are in broad areas. Typically, the surface layer is very dark gray to black silty clay loam about 24 inches thick. Below that, very dark gray silty clay extends to a depth of 35 inches, and dark gray clay extends to a depth of 54 inches. The underlying material to a depth of 60 inches is white, platy chalk. Typically, these soils are mildly alkaline in the surface layer and moderately alkaline in other layers.

The Dalco soils are gently sloping. They are in broad areas. Typically, the surface layer is very dark gray silty clay loam about 5 inches thick. Below that, to a depth of 31 inches, the soil is clay that is black in the upper part and dark gray in the lower part. The underlying material is white, platy chalk. Typically, these soils are moderately alkaline throughout.

The other soils included in mapping are Crockett, Houston Black, Leson, Stephen, and Tinn soils. The clayey Houston Black, Leson, and Stephen soils and the loamy Crockett soils are in positions on the landscape similar to those of the Fairlie and Dalco soils. The clayey Tinn soils are on flood plains of streams.

The soils in this map unit have high potential for use as cropland and pastureland and medium potential for native grasses.

Their potential for most urban and recreation uses is low. The main limitations are the clayey surface texture, the very slow permeability, and the depth to rock.

loamy soils on uplands

This group of soils makes up about 47 percent of the county. It consists of Crockett, Axtell, Wilson, Lufkin, Rader, and Lamar soils. These soils are nearly level to strongly sloping, well drained to somewhat poorly drained, and moderately permeable to very slowly permeable.

In most areas, these soils are used for pasture. Improved pastures consist mainly of bermudagrass, bahiagrass, weeping lovegrass, vetch, singletary peas, and arrowleaf clover. The native grasses on these soils are bluestem, indiangrass, paspalum, and panicum.

The soils in this group have medium to low potential for urban and recreation uses.

4. Crockett

Loamy, deep, gently sloping, moderately well drained soils

This map unit is made up of soils that have slopes of 1 to 5 percent. It makes up about 22 percent of the county. Crockett soils make up about 62 percent of the map unit; other soils make up 38 percent.

Crockett soils are gently sloping. They are in broad areas. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The layer below that, to a depth of about 53 inches, is clay that is dark reddish brown in the upper part and grades to light olive brown in the lower part; this layer has brownish and yellowish mottles throughout. The underlying material, to a depth of 65 inches, is grayish shaly clay. These soils are medium acid in the upper part and grade to moderately alkaline in the lower part.

The other soils included in mapping are Axtell, Ferris, Heiden, Hopco, Leson, Lufkin, Nahatche, Rader, and Wilson soils. The clayey Leson soils are in positions on the landscape similar to those of the Crockett soils. The clayey Ferris and Heiden soils and the loamy Axtell soils are on side slopes above drainageways. The loamy Wilson, Lufkin, and Rader soils are in nearly level to slightly depressed positions. The loamy Nahatche and Hopco soils are on flood plains of streams.

The soils in this unit have medium potential for use as pasture or cropland and for native grasses.

Their potential for most urban and recreation uses is medium. Very slow permeability and shrink-swell potential are the main limitations.

5. Axtell

Loamy, deep, gently sloping to strongly sloping, moderately well drained soils

This map unit consists of soils that have slopes of 2 to 12 percent. It makes up about 10 percent of the county. Axtell soils make up about 52 percent of this map unit, and other soils make up 48 percent.

The Axtell soils are gently sloping to strongly sloping. They are on ridgetops and side slopes above drainageways. Typically, the surface layer is slightly acid, dark grayish brown loam about 4 inches thick. Below that, to a depth of 8 inches, the soil is slightly acid, light yellowish brown loam, and to a depth of 34 inches it is strongly acid, yellowish red clay that has reddish, brownish, and grayish mottles. Below that, to a depth of 53 inches, the soil is slightly acid, mottled brownish clay loam. The underlying layer to a depth of 80 inches is mildly alkaline, grayish sandy clay loam.

The other soils included in mapping are Bazette, Crockett, Lufkin, Nahatche, and Rader soils. The loamy Crockett and Bazette soils are in positions on the landscape similar to those of the Axtell soils. The loamy Lufkin and Rader soils are in nearly level to slightly depressed areas. The loamy Nahatche soils are on the flood plains of streams.

The soils in this map unit have low potential for use as cropland because of the slope and the hazard of erosion. In some areas they are not suited to cultivation because of these limitations. Their potential for improved pasture is medium, and their potential for native grasses is low. The soils produce a fairly dense stand of oak and elm.

Their potential for most urban and recreation uses is medium. Slope, very slow permeability, and shrinking and swelling are the main limitations.

6. Wilson

Loamy, deep, nearly level, somewhat poorly drained soils

This map unit consists of soils that have slopes of 0 to 1 percent. It makes up about 9 percent of the county. Wilson soils make up about 70 percent of this map unit, and other soils make up 30 percent.

The Wilson soils are in broad areas. Typically, the surface layer is medium acid, dark grayish brown silt loam about 6 inches thick. The subsoil to a depth of 64 inches is slightly acid or neutral clay. It is very dark gray in the upper and middle parts and dark grayish brown in the lower part. Below that, to a depth of 80 inches, it is moderately alkaline, light gray silty clay.

The other soils included in mapping are Burleson, Crockett, Lufkin, and Rader soils. The loamy Lufkin and Rader soils and the clayey Burleson soils are in positions on the landscape similar to those of the Wilson soils. The loamy Crockett soils are in slightly higher, gently sloping positions.

The soils in this map unit have medium potential for pastureland, cropland, and native grasses.

Their potential for most urban and recreation uses is low. Wetness, shrinking and swelling, and very slow permeability are the main limitations.

7. Lufkin-Rader

Loamy, deep, nearly level, moderately well drained and somewhat poorly drained soils

This map unit consists of loamy soils that have slopes of 0 to 1 percent. It makes up about 3 percent of the county. Lufkin and Rader soils make up about 69 percent of this map unit, and other soils make up 31 percent.

The Lufkin and Rader soils are in broad, nearly level or mounded areas. The Lufkin soils are somewhat poorly drained. They are in areas between the mounds. The Rader soils are moderately well drained. They are on mounds.

Typically, the surface layer of the Lufkin soils is slightly acid, grayish brown loam about 4 inches thick. The subsurface layer is medium acid, light brownish gray loam 4 inches thick. Below that, to a depth of 80 inches, the soil is very strongly acid, slightly acid, or mildly alkaline, brownish and grayish clay.

Typically, the surface layer of the Rader soils is slightly acid, brown loam about 6 inches thick. The next layer, to a depth of 20 inches, is very strongly acid loam that is yellowish brown in the upper part and strong brown in the lower part. The next layer, to a depth of 27 inches, is very strongly acid clay loam mottled with yellowish red, red, and brown. The underlying layer to a depth of 80 inches is strongly acid clay mottled with gray, light brownish gray, and red.

The soils included in mapping are Axtell, Crockett, and Wilson soils. The loamy Wilson soils are in positions on the landscape similar to those of the Lufkin and Rader soils. The loamy Axtell soils are on side slopes above drainageways. The gently sloping, loamy Crockett soils are on low ridges.

The soils in this map unit have medium potential for use as cropland and pastureland. Their potential for producing native grasses is low. Most of the soils produce a fairly dense stand of oak and elm.

The potential for most urban and recreation uses is low. Very slow permeability, shrinking and swelling, and seasonal wetness are the main limitations.

8. Rader

Loamy, deep, nearly level and gently sloping, moderately well drained soils

This map unit consists of loamy soils that have slopes of 1 to 3 percent. It makes up about 2 percent of the county. Rader soils make up about 52 percent of this map unit, and other soils make up 48 percent.

The Rader soils are on interstream divides. Typically, the surface layer is brown fine sandy loam about 22 inches thick. Below that, to a depth of 34 inches, the soil is yellowish brown sandy clay loam. The underlying layer to a depth of about 70 inches is sandy clay that has grayish, reddish, and brownish mottles. These soils are slightly acid to strongly acid.

The other soils included in mapping are Axtell, Crockett, and Lufkin soils. The loamy Crockett soils are in positions on the landscape similar to those of the Rader soils. The loamy Axtell soils are on ridgetops and side slopes above drainageways. The loamy Lufkin soils are in slightly depressed wet areas.

The soils in this map unit have high potential for use as pastureland. Their potential for use as cropland and for producing native grasses is medium. In some areas these soils support a fairly dense stand of oak and elm.

The potential for most urban and recreation uses is medium. Very slow permeability, shrinking and swelling, and a seasonal high water table are the main limitations. These soils are an excellent source of topsoil.

9. Lamar

Loamy, moderately deep, sloping and strongly sloping, well drained soils

This map unit consists of loamy soils that have slopes of 5 to 12 percent. It makes up slightly less than 1 percent of the county. Lamar soils make up about 52 percent of this map unit, and other soils make up 48 percent.

The Lamar soils are sloping and strongly sloping. They are on side slopes above drainageways. Typically, the surface layer is moderately alkaline, dark grayish brown loam 4 inches thick. Below that, to a depth of 36 inches, the soil is moderately alkaline, light olive brown loam. The underlying layer to a depth of 50 inches consists of strata of loam, clay loam, and shaly clay in variegated browns and grays.

The other soils included in mapping are Axtell, Crockett, and Ferris soils and the closely similar Bazette soils. The loamy Axtell and Bazette soils and the clayey Ferris soils are in positions on the landscape similar to those of the Lamar soils. The gently sloping loamy Crockett soils are on ridgetops.

The soils in this map unit are generally not suited to use as cropland because of the slope and the hazard of erosion. Their potential for use as pastureland is low. Their potential for producing native grasses is medium. Most of the soils produce a fairly dense stand of oak and elm.

These soils have medium potential for most urban and recreation uses. Slope is the most restrictive limitation.

clayey soils on bottom lands

This group of soils makes up about 11 percent of the county. The major soils are Kaufman and Tinn soils. These are nearly level, clayey soils on flood plains of major streams. They are somewhat poorly drained and very slowly permeable. They are flooded usually for 2 to 7 days, 1 to 5 times in most years.

These soils are used primarily as pastureland. The improved pastures consist mainly of bermudagrass, fescue, dallisgrass, white clover, and singletary peas. About one-third of these soils support a fairly dense stand of oak, elm, pecan, green ash, and cottonwood. Virginia wildrye, longleaf uniola, and sedges dominate the understory. Eastern gamagrass, giant paspalum, beaked panicum, Canada wildrye, indiangrass, and switchgrass are the native grasses in open areas.

These soils are not suited to cultivation because of the flooding. If the flooding is controlled, the potential for cotton, grain sorghum, and wheat is high.

These soils have low potential for most urban and recreation uses. The hazard of flooding is the major limitation. The very slow permeability, the shrink-swell potential, and the clayey surface texture are limitations also.

10. Kaufman-Tinn

Clayey, deep, nearly level, somewhat poorly drained soils

This map unit consists of soils on flood plains that have slopes of 0 to 1 percent. It makes up about 11 percent of the county. Kaufman soils make up about 51 percent of the map unit, Tinn soils make up 24 percent, and other soils make up 25 percent.

The Kaufman soils are on the large flood plains of major rivers and streams carrying mainly noncalcareous sediment. Typically, the soil is black clay to a depth of about 53 inches. It is mildly alkaline to a depth of 6 inches and moderately alkaline below that depth. Below a depth of 53 inches, and to a depth of 80 inches, the soil is slightly acid, very dark gray clay.

The Tinn soils are on the large flood plains of major rivers and streams carrying mainly calcareous sediment. Typically, the soil is moderately alkaline, black clay to a depth of about 76 inches. There are very dark gray mottles between the depths of 26 and 39 inches.

The other soils included in mapping are Hopco, Houston Black, Leson, and Nahatche soils. The loamy Nahatche and Hopco soils are on the flood plains of small tributaries of the major streams. The clayey Leson and Houston Black soils are on foot slopes above the flood plains.

The soils in this map unit have low potential for use as cropland because of flooding; however, in some areas that are only ocassionally flooded, the soils have high potential. The potential for use as pasture and for producing native grasses is high.

Their potential for most urban and recreation uses is low. The hazard of flooding is the main limitation to these uses. The shrinking and swelling and very slow permeability are limitations also.

broad land use considerations

The soils in Hunt County vary widely in their potential for major land uses. In table 4, the potential of each general soil map unit, in relation to the other general soil map units, is given for various land uses. Soil limitations are also given. The ratings of soil potential reflect the cost of needed conservation practices and the hazard of soil-related problems continuing after such practices have been installed. The ratings do not take into account the distance of the soils to existing transportation systems or to other facilities.

The land uses listed in table 4 are cultivated crops, pasture, urban uses, and recreation areas. The cultivated crops grown in the county include cotton, grain sorghum, wheat, and oats. Pasture refers to land in improved grasses and legumes, for example, coastal bermudagrass, fescue, vetch, and singletary peas. Urban uses include residential, commercial, and industrial sites. Recreation areas are nature study areas, paths and trails, picnic areas, camp areas, and playgrounds.

In general, the kind of soil and its proximity to developing areas, such as towns, and to lakes are the most important factors influencing land use in Hunt County.

About 51 percent of the survey area is used for cultivated crops, and about 31 percent is used for pasture and hay. According to table 4, the potential of the soils for use as pasture is high in about 44 percent of the survey area, medium in about 44 percent of the area, and low in about 7 percent of the area. The potential of the soils for use as cultivated cropland is high in about 31 percent of the survey area, medium in about 36 percent of the area, and low in about 28 percent of the area. According to these figures, about 16 percent of the survey area could profitably be converted to cultivated cropland if economic conditions were favorable.

In Hunt County, the acreage used for cultivated crops has increased slightly in recent years. Most of the added acreage is land that was idle but has been cultivated at one time.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Axtell loam, 2 to 5 percent slopes, is one of two phases in the Axtell series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Lufkin-Rader complex is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Fairlie and Dalco soils, 1 to 4 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Axtell loam, 2 to 5 percent slopes. This is a gently sloping soil on ridgetops and side slopes of uplands above drainageways. Individual areas are irregular in shape and range from about 30 to 200 acres in size.

Typically, the surface layer is slightly acid, dark grayish brown loam about 4 inches thick. Below that, to a depth of 8 inches, the soil is slightly acid, light yellowish brown loam, and to a depth of 34 inches, it is strongly acid clay that is yellowish red in the upper part, grayish brown in the middle part, and light brownish gray in the lower part and has reddish and brownish mottles throughout. To a depth of 53 inches the soil is slightly acid, grayish brown clay loam with yellowish brown mottles. The underlying material to a depth of 80 inches is mildly alkaline, light brownish gray sandy clay loam that has olive yellow mottles.

This soil is moderately well drained. Runoff is medium to rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

Included in mapping are small areas of Lufkin and Rader soils. Lufkin soils are in small wet spots. Rader soils are on low mounds and on foot slopes. Also included are areas of Axtell soils, eroded, and areas of Axtell gravelly loam. The included soils make up 10 to 20 percent of most mapped areas.

This soil is used mainly as pasture. It has medium potential for bermudagrass, bahiagrass, and weeping lovegrass. Bermudagrass pasture is commonly overseeded with vetch, singletary peas, or arrowleaf clover. These plants add nitrogen to the soil, control erosion, and provide grazing early in spring while the bermudagrass is dormant. Applications of lime, nitrogen, phosphorus, and potassium are needed to increase yields.

This soil has low potential for use as cropland because of the hazard of erosion. It is best suited to small grain, grain sorghum, and hay crops. Crop residue should be left on the surface to help control erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming help control erosion on this gently sloping soil. Grassed waterways may be needed to control excess runoff from terraces.

This soil has high potential for use as wildlife habitat. It has low potential for producing native grasses.

This soil has medium potential for most urban and recreation uses. The shrink-swell potential and very slow permeability are limitations.

This soil is in capability subclass IVe.

2—Axtell loam, 5 to 12 percent slopes. This is a sloping to strongly sloping soil generally on narrow side slopes of uplands above drainageways. In some areas it is on ridgetops and upper side slopes. Individual areas are long and narrow and range from 20 to about 200 acres in size.

Typically, the suface layer is slightly acid, brown loam about 5 inches thick. Below that, to a depth of 9 inches, the soil is medium acid, yellowish brown loam. To a depth of 46 inches, it is strongly acid, yellowish red and light brownish gray clay that has reddish and brownish mottles throughout. The underlying material, to a depth of 64 inches, is medium acid, light brownish gray sandy clay loam that has strong brown mottles.

This soil is moderately well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a severe hazard.

Included in mapping are small areas of Bazette and Gasil soils. Also included are small areas of Axtell soils, eroded, and a few areas of Axtell gravelly loam. The included soils make up 10 to 20 percent of most mapped areas.

This soil is used mainly as pasture. It has low potential for bermudagrass, bahiagrass, and weeping lovegrass. Bermudagrass pasture is commonly overseeded with vetch, singletary peas, or arrowleaf clover. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring while the bermudagrass is dormant. Applications of lime, nitrogen, phosphorus, and potassium are needed to produce good yields.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

The soil has low potential for producing native grasses. It has high potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and slope are limitations. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass VIe.

3—Bazette clay loam, 5 to 12 percent slopes. This is a sloping to strongly sloping soil on side slopes of uplands above drainageways. Individual areas are dominantly long and narrow and range from 25 to 200 acres in size.

Typically, the surface layer is neutral, very dark grayish brown and olive brown clay loam about 12 inches thick. Below that, to a depth of 24 inches, the soil is neutral, light olive brown clay. To a depth of 39 inches, it is moderately alkaline, light olive brown clay loam with grayish brown mottles. Layers of moderately alkaline, light yellowish brown and grayish brown clay loam and shale extend to a depth of 60 inches.

This soil is well drained. Runoff is rapid to very rapid. Permeability is slow, and the available water capacity is high. Water erosion is a severe hazard.

Included in mapping are small areas of Axtell, Crockett, and Lamar soils. The Crockett soils have slopes of less than 5 percent. In a few areas, discontinuous limestone lentils as much as 8 inches thick are below a depth of 4 feet. The included soils make up less than 20 percent of most mapped areas.

This soil is used mainly as pasture, though it has low potential for use as pasture. It is best suited to grasses and legumes, for example, bermudagrass, weeping lovegrass, vetch, singletary peas, and arrowleaf clover.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

This soil has high potential for use as wildlife habitat. It has medium potential for producing native grasses.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, slow permeability, and slope are the major limitations. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation developments.

This soil is in capability subclass VIe.

4—Branyon clay, 0 to 1 percent slopes. This is a nearly level soil on old terraces. The areas are oval or irregular in shape, and they range from about 50 to 500 acres in size.

Typically, the surface layer is moderately alkaline, black clay about 53 inches thick. Below that, to a depth of 68 inches, the soil is moderately alkaline, dark gray clay that has very dark gray and yellowish brown mottles.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

Included in mapping are small areas of Burleson soils. They make up less than 10 percent of any mapped area.

The Branyon soil is used mainly as cropland. It has high potential for cotton, grain sorghum, and small grains. The residue from these crops should be left on the surface to improve water infiltration and maintain the content of organic matter. Nitrogen and phosphorus fertilizer may be needed to increase yields.

This soil has high potential for pasture of bermudagrass and weeping lovegrass. Bermudagrass pasture is commonly overseeded with vetch and singletary peas. These legumes add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant.

This soil has high potential for native grasses. It has medium potential for the development of habitat for wildlife.

This soil has low potential for most urban and recreation uses because it shrinks and swells with changes in moisture, is very slowly permeable, and has a clayey surface layer. These limitations are difficult and costly to overcome; however, with proper design and careful installation procedures, this soil can be used for urban and recreation uses.

This map unit is in capability subclass IIw.

5—Burleson clay, 0 to 1 percent slopes. This is a nearly level soil on old terraces. Individual areas are oval or irregular in shape and range from 50 to 1,000 acres in size.

Typically, the surface layer is slightly acid, very dark gray clay about 5 inches thick. Below that, to a depth of 40 inches, the soil is neutral, very dark gray clay. To a depth of 66 inches, it is moderately alkaline, dark gray clay. To a depth of 80 inches, it is moderately alkaline, gray clay.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

Included in mapping are small areas of Wilson and Leson soils. The included soils make up less than 10 percent of any mapped area.

This soil is used mainly as cropland. It has high potential for producing cotton, grain sorghum, and small grains. Crop residue should be left on the surface to increase water infiltration and maintain the content of organic matter. Nitrogen, phosphorus, and potassium may be needed to increase yields.

This soil has high potential for bermudagrass and weeping lovegrass. Bermudagrass pasture is commonly overseeded with vetch or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring while the bermudagrass is dormant.

The soil has medium potential for producing native grasses. It has medium potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass IIw.

6—Crockett loam, 1 to 3 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from about 15 to 700 acres in size.

Typically, the surface layer is medium acid, dark grayish brown loam about 7 inches thick. Below that, to a depth of 12 inches, the soil is slightly acid, dark reddish brown clay. To a depth of 22 inches, it is slightly acid, mottled yellowish brown, dark grayish brown, and reddish brown clay. To a depth of 41 inches, it is mildly alkaline, dark grayish brown clay that has yellowish brown mottles. To a depth of 65 inches, it is moderately alkaline clay that is light olive brown in the upper part and variegated brownish, grayish, and olive in the lower part.

This soil is moderately well drained. Runoff is slow to medium. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

Included in mapping are small areas of Wilson soils. These soils are generally in low wet spots. Also included are small areas of eroded Crockett soils. The included soils make up 5 to 20 percent of most mapped areas.

This soil is used mainly as pasture. It has medium potential for bermudagrass, bahiagrass, and weeping lovegrass (fig. 1). Bermudagrass pasture can be overseeded with vetch, singletary peas, and arrowleaf clover. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring while the bermudagrass is dormant.

This soil has medium potential for cotton, grain sorghum, and small grains. Crop residue should be left on the surface to help control water erosion and maintain the content of organic matter. Terracing and contour farming are needed to control erosion on these gently sloping soils. Grassed waterways may be needed to carry runoff from terraces. This soil may need nitrogen, phosphorus, potassium, and lime to increase yields.

This soil has medium potential for producing native grasses. It has high potential for use as wildlife habitat.

This soil has medium potential for most urban and recreation uses. The shrink-swell potential and very slow permeability are the main limitations.

This soil is in capability subclass IIIe.

7—Crockett loam, 2 to 5 percent slopes, eroded. This is a gently sloping soil on side slopes of uplands above drainageways. In most areas, the soil has rills and shallow gullies. The gullies are 10 to about 75 feet wide and 1 to 3 feet deep. They are at intervals of 75 to 300 feet. Most can be crossed by farm machinery. In some areas, this soil has few or no gullies. The surface layer in

Figure 1.—Bermudagrass pasture in an area of Crockett loam, 1 to 3 percent slopes.

these areas is less than 5 inches thick because of sheet erosion. Individual areas are long and narrow or irregular in shape and range from about 20 to 300 acres in size.

The texture of the surface layer is variable, ranging from loam to clay loam. This variability is not uniform and does not occur in a regular pattern.

Typically, the surface layer is medium acid, dark brown loam about 4 inches thick. Below that, to a depth of 12 inches the soil is slightly acid, mottled dark reddish brown, very dark grayish brown, and yellowish brown clay. To a depth of 32 inches, it is neutral, dark grayish brown clay that has olive brown and yellowish red mottles. To a depth of 40 inches, it is moderately alkaline clay mottled with browns, yellows, and grays. The underlying material, to a depth of 60 inches, is moderately alkaline, yellowish and brownish variegated shaly clay, clay loam, and shale.

This soil is moderately well drained. Runoff is medium to rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a severe hazard

Included in mapping are small areas of Leson and Axtell soils. The included soils make up less than 10 percent of most mapped areas.

This Crockett soil is used mainly as pastureland; however, it has low potential for this use. It is suited to bermudagrass, bahiagrass, and weeping lovegrass. Bermudagrass pastures may be overseeded with vetch, singletary peas, and arrowleaf clover. These plants add nitrogen to the soil, help control water erosion, and provide grazing early in spring while the bermudagrass is dormant. Nitrogen, phosphorus, and potassium may be needed to increase yields.

This soil has low potential for use as cropland because of the hazard of water erosion and the thin surface layer. It is best suited to close-growing crops, for example, wheat and oats.

This soil has low potential for native grass production. It has high potential for use as wildlife habitat.

This soil has medium potential for most urban and recreation uses. The shrink-swell potential and very slow permeability are the main limitations.

This soil is in capability subclass IVe.

8—Crockett-Urban land complex, 1 to 3 percent slopes. This complex consists of gently sloping soils in urban areas on uplands. The areas are irregular in shape and range from about 40 to 800 acres in size.

Crockett loam makes up 35 to 70 percent of this complex, Urban land makes up 20 to 50 percent, and other soils make up as much as 15 percent. The areas of the components are so intricately mixed that is was not practical to separate them at the scale of mapping used for this survey.

Typically, the surface layer of the Crockett soil is medium acid, dark grayish brown loam about 7 inches thick. Slightly acid, dark reddish brown clay is between depths of 7 and 12 inches. Slightly acid, mottled yellowish brown, dark grayish brown, and reddish brown clay is between depths of 12 and 22 inches. Mildly alkaline, dark grayish brown clay that has yellowish brown mottles is between depths of 22 and 41 inches. Between depths of 41 and 65 inches, there is moderately alkaline clay that is light olive brown in the upper part and variegated brownish, grayish, and olive in the lower part.

The Crockett soil is moderately well drained. Runoff is medium. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

In areas of Urban land, the soils have been altered or covered by buildings or other structures to the point that classification is not practical. The areas are sites for houses, apartment buildings, streets, highways, cemeteries, schools, playgrounds, churches, parking lots, shopping centers, and the Greenville airport. Urban land also includes areas of Crockett soils that have been altered by filling, cutting, or grading during urban development.

Included in mapping are small areas of Wilson soils.

The soils making up this complex have medium potential for most urban and recreation uses. The main limitations are the shrinking and swelling of the soils with changes in moisture and the very slow permeability.

This unit is not assigned to a capability subclass.

9—Fairlie and Dalco soils, 1 to 4 percent slopes. These are gently sloping soils on uplands. Individual areas are oblong or irregular in shape and range from about 25 to 500 acres in size.

These soils are not uniform and do not occur in a regular pattern. Fairlie soils make up 30 to 75 percent of most areas, Dalco soils make up 10 to 55 percent, and other soils make up as much as 20 percent.

Typically, the surface layer of the Fairlie soils is mildly alkaline, very dark gray silty clay loam about 5 inches thick (fig. 2). Below that, to a depth of 24 inches, the soil is moderately alkaline, black silty clay loam. To a depth of 35 inches, it is moderately alkaline, very dark gray silty clay that has olive mottles. To a depth of 54 inches, it is moderately alkaline, dark gray clay that has yellowish brown and olive mottles. The underlying material, to a depth of 60 inches, is moderately alkaline, white platy chalk.

Typically, the surface layer of the Dalco soils is moderately alkaline, very dark gray silty clay loam about 5 inches thick. Below that, to a depth of 14 inches, the soil is moderately alkaline, black clay. To a depth of 31 inches, it is moderately alkaline, dark gray clay. The substratum, to a depth of 38 inches, is moderately alkaline, white platy chalk.

These soils are moderately well drained. Runoff is medium, and permeability is very slow. The available water capacity is medium for the Fairlie soils and low for the Dalco soils. Water erosion is a slight hazard.

Included in mapping are small areas of Houston Black and Stephen soils.

The Fairlie and Dalco soils are used mainly as cropland and pasture. They have high potential for producing cotton, grain sorghum, and small grains. Crop residue should be left on the surface to help control erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming are needed to control erosion on these gently sloping soils. Grassed waterways may be needed to control excess runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

These soils have high potential for bermudagrass and weeping lovegrass. Bermudagrass pasture is commonly overseeded with vetch and singletary peas. These plants add nitrogen to the soil and provide grazing early in spring while the bermudagrass is dormant.

The soils have medium potential for producing native grasses. They have high potential for use as wildlife habitat.

These soils have low potential for most urban and recreation uses. The shrink-swell potential, very slow

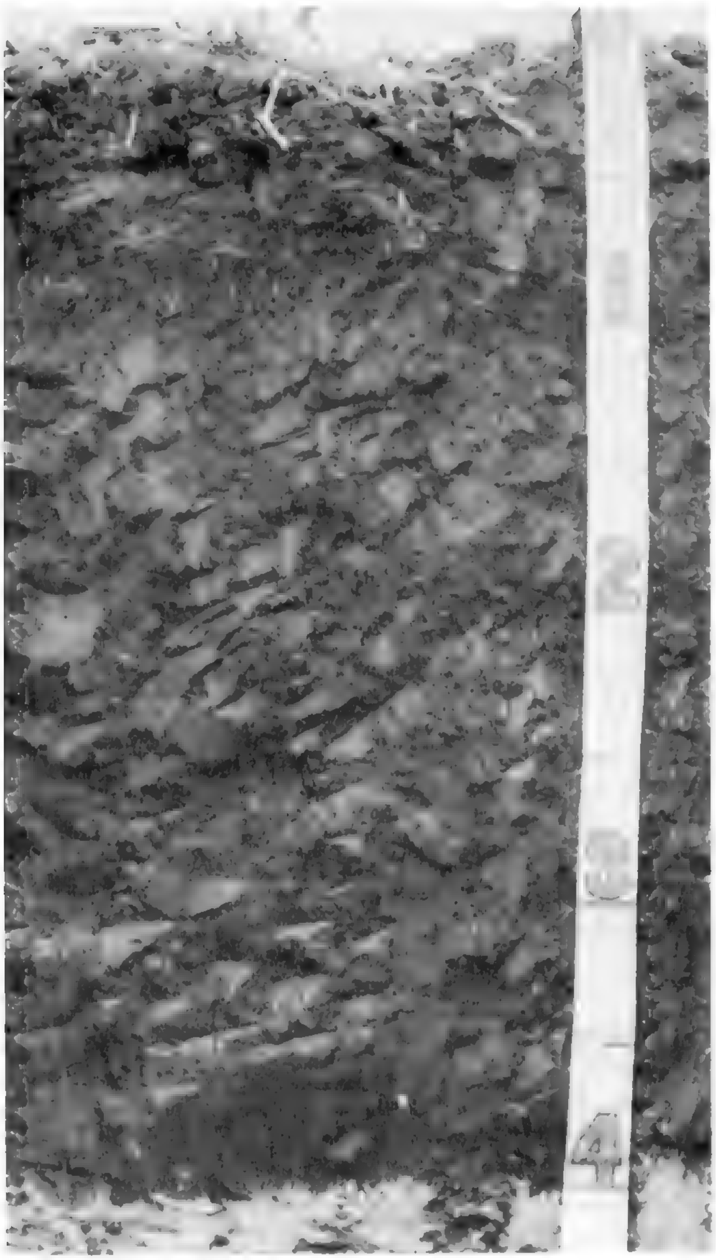

Figure 2.—Profile of Fairlie silty clay loam. The depth to chalk ranges from 40 to 60 inches.

permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and careful installation, these soils can be used for urban and recreation purposes.

These soils are in capability subclass IIe.

10—Ferris clay, 5 to 12 percent slopes, eroded. This is a sloping to strongly sloping soil on side slopes of uplands above drainageways. In most areas this soil has rills and shallow gullies. The gullies are 25 to 75 feet wide and 1 to 4 feet deep. They are at intervals of 50 to 300 feet. Most can be crossed by farm machinery. Individual areas of this soil are long and narrow and range from about 20 to 300 acres.

Typically, to a depth of about 42 inches this soil is moderately alkaline clay that is dark olive gray in the upper part and olive in the lower part. Below that, variegated layers of grayish, brownish, and olive shale and shaly clay extend to a depth of 76 inches.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a severe hazard.

Included in mapping are small areas of Heiden and Houston Black soils. The included soils make up 3 to 15 percent of most mapped areas.

This soil is used mainly as pasture; however, it has low potential for this use. It is suited to bermudagrass, weeping lovegrass, kleingrass, vetch, and singletary peas.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

The soil has medium potential for producing native grasses. It has medium potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The main limitations are the shrink-swell potential, slope, very slow permeability, and clayey surface layer. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass VIe.

11—Ferris-Heiden complex, 2 to 5 percent slopes, eroded. These are gently sloping soils on ridges and side slopes of uplands above drainageways. There are rills and shallow gullies in most areas. The gullies are at intervals of about 50 to 500 feet. They are 1 to 4 feet deep and 10 to 100 feet wide. Most can be crossed by farm machinery. In other areas, part of the surface layer has been removed by sheet erosion. Individual areas are irregular in shape and range from about 20 to 300 acres in size.

This complex is made up of about 50 percent Ferris soils, 35 percent Heiden soils, and 15 percent other soils. Areas of these soils are so intricately mixed that it was not practical to separate them at the scale of mapping used for this survey.

Typically, the Ferris soils have a surface layer of moderately alkaline, dark olive gray clay about 4 inches thick. Below that, to a depth of 30 inches, the soil is moderately alkaline, olive clay. To a depth of 52 inches it is moderately alkaline, light yellowish brown clay that has olive mottles and dark olive gray streaks. The underlying material to a depth of 65 inches is moderately alkaline, mottled light gray, yellowish brown, and light olive brown shaly clay.

Typically, the surface layer of the Heiden soils is moderately alkaline, very dark gray clay about 5 inches thick. Below that, to a depth of 58 inches, the soil is moderately alkaline, dark grayish brown and olive clay. The underlying material, to a depth of 65 inches, is variegated brownish, grayish, and yellowish shaly clay.

These soils are well drained. Runoff is medium to rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a severe hazard.

Included in mapping are small, intricately mixed areas of Leson, Houston Black, and Crockett soils. Also included are small areas of Ferris and Heiden soils that have slopes of more than 5 percent.

These soils are used mainly as pasture. They have low potential for bermudagrass and weeping lovegrass. Bermudagrass pasture can be overseeded with vetch or singletary peas. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring while the bermudagrass is dormant.

These soils have low potential for use as cropland. The hazard of erosion is the main limitation. These soils are best suited to close-growing crops. Crop residue should be left on the surface to help control erosion, maintain the content of organic matter, and increase water infiltration. Terracing and contour farming are essential to control erosion on these gently sloping soils. Grassed waterways may be needed to control excess runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

The soils have medium potential for producing native grasses. They have medium potential for use as wildlife habitat.

These soils have low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and installation, these soils can be used for urban and recreation purposes.

These soils are in capability subclass IVe.

12—Gasil loamy fine sand, 8 to 12 percent slopes. This is a strongly sloping soil mainly on side slopes of uplands above drainageways. Individual areas are long and narrow and range from about 8 to 50 acres in size.

Typically, the surface layer is slightly acid, dark grayish brown loamy fine sand about 6 inches thick. Below that, to a depth of 19 inches, the soil is neutral, brown loamy fine sand. To a depth of 60 inches, it is very strongly acid yellowish brown and light olive brown sandy clay loam. To a depth of 72 inches, it is extremely acid, light olive brown sandy clay loam that has strong brown and light gray mottles.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. Water erosion is a moderate hazard.

Included in mapping are small areas of Axtell soils. Also included are areas of soils similar to this Gasil soil except that they have a surface layer of loamy fine sand 20 to 40 inches thick. These soils commonly are on narrow ridgetops. The included soils make up 5 to 25 percent of most mapped areas.

This soil is used mainly for urban development and as a source of topsoil for landscaping.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

This soil has low potential for use as pastureland. It is suited to bermudagrass, weeping lovegrass, bahiagrass, vetch, and singletary peas.

The soil has medium potential for producing native grasses. It has high potential for use as wildlife habitat.

This soil has medium potential for most urban and recreation uses. Slope is the main limitation.

This soil is in capability subclass VIe.

13—Heiden clay, 2 to 5 percent slopes. This is a gently sloping soil on ridges and side slopes of uplands above drainageways. Individual areas are long and narrow and range from about 20 to 100 acres in size.

Typically, moderately alkaline clay extends to a depth of about 58 inches. It is very dark gray in the upper part grading to light yellowish brown in the lower part. The underlying material, to a depth of 78 inches, is moderately alkaline, variegated yellowish and grayish shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

Included in mapping are small areas of Ferris and Houston Black soils. Also included are small areas of Heiden soils that have slopes of more than 5 percent. The included soils make up less than 20 percent of most mapped areas.

This soil is used mainly as pasture. It has medium potential for bermudagrass and weeping lovegrass. Vetch and singletary peas are used for overseeding bermudagrass pasture. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring while the bermudagrass is dormant.

This soil has medium potential for cotton, grain sorghum, and small grains. Crop residue should be left on the surface to help control erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming are essential in controlling erosion on these gently sloping soils. Grassed waterways may be needed to control excess runoff from terraces.

The soil has high potential for production of native grasses (fig. 3). It has medium potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass IIIe.

Figure 3.—Native grass meadow adjacent to Lake Tawakoni. The soil is Heiden clay, 2 to 5 percent slopes.

14—Heiden clay, 5 to 8 percent slopes. This is a sloping soil mainly on side slopes of uplands above drainageways. Individual areas are irregular in shape and range from about 20 to 100 acres in size.

Typically, the soil is moderately alkaline clay to a depth of about 42 inches. It is black in the surface layer and grades to olive in the lower part. The underlying material, to a depth of 62 inches, is variegated grayish and brownish shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a severe hazard.

Included in mapping are small areas of Ferris soils. Also included are small areas of Heiden soils that have slopes of less than 5 percent. The included soils make up 5 to 15 percent of most mapped areas.

This soil is used mainly as pasture and native grass meadows (fig. 4). It has low potential for bermudagrass and weeping lovegrass. Bermudagrass pastures can be overseeded with vetch or singletary peas. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring while the bermudagrass is dormant.

This soil has low potential for use as cropland. Slope and the hazard of erosion are limitations. The soil is suited to close-growing crops for example, oats and wheat. Crop residue should be left on the surface to help control erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming help control erosion on this sloping soil. Grassed waterways may be needed to control excess runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

This soil has high potential for native grasses. It has medium potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, slope, and clayey surface layer are the main limitations. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass IVe.

15—Heiden-Urban land complex, 3 to 6 percent slopes. This complex consists of gently sloping soils on

ridges and side slopes of uplands above drainageways. It is mainly in urban areas and on the fringe of urban areas. The areas are long and narrow and range from about 20 to 100 acres in size.

Heiden clay makes up 30 to 65 percent of this complex, Urban land makes up 10 to 50 percent, and other soils make up as much as 25 percent. The areas of the components are so intricately mixed that it was not practical to separate them at the scale of mapping used for this survey.

Typically, the Heiden soil is moderately alkaline clay to a depth of about 58 inches. It is very dark gray in the upper part and grades to light yellowish brown in the lower part. The underlying material, to a depth of 78 inches, consists of layers of moderately alkaline, variegated gray, brownish yellow, and light brownish gray shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

In areas of Urban land, the soils that support buildings and other structures have been covered or altered to the point that classification is not practical. The areas are sites for houses, apartment buildings, streets, schools, churches, cemeteries, parking lots, industrial complexes, highways, and shopping centers. Urban land also includes small areas of Heiden soils that have been altered by filling, cutting, or grading during urban development.

Included in mapping are small areas of Ferris soils.

The soils making up this complex have low potential for most urban and recreation uses. The main limitations are the shrinking and swelling of the soils with changes in moisture, the very slow permeability, and the clayey surface layer. These limitations are difficult and costly to overcome. However, through proper design and careful installation, the soils can be used for urban and recreation purposes.

This unit is not assigned to a capability subclass.

16—Hopco silt loam, frequently flooded. This is a nearly level soil on flood plains of streams. Slopes are less than 1 percent. The areas are mainly long and narrow in shape. They range from 75 to 400 acres in size and are 100 feet to 1 mile wide.

Typically, the surface layer is neutral, very dark grayish brown silt loam about 7 inches thick. Neutral, very dark gray silty clay loam is between depths of 7 and 32 inches. Mildly alkaline, very dark grayish brown clay loam

Figure 4.—Native grass meadow and farm pond in an area of Heiden clay, 5 to 8 percent slopes. The soils in the background are mainly Houston Black clay, 1 to 3 percent slopes.

is between depths of 32 and 52 inches. The underlying layer between depths of 52 and 67 inches is moderately alkaline, dark grayish brown clay loam. Yellowish brown mottles typically occur in the lower part of the soil.

This soil is somewhat poorly drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is high. Water erosion is a slight hazard. This soil is flooded 2 to 5 times in most years and remains flooded for a period of 1 to 4 days after heavy rains.

Included in mapping are small areas of Kaufman and Nahatche soils. Also included are areas of Hopco soils that are flooded only once or twice in an average 5-year period because they are protected by levees or are in positions slightly higher than this frequently flooded Hopco soil. The included soils make up 10 to 20 percent of most mapped areas.

This soil is used mainly as pasture. It has high potential for pasture of bermudagrass or fescue overseeded with legumes such as white clover and singletary peas. Nitrogen, phosphorus, and potassium may be needed to increase yields.

This soil has high potential for the development of habitat for wildlife. It has high potential for native grasses.

This soil is not suited to cultivation because of flooding and wetness. It has high potential for crops if flooding is controlled.

The soil has low potential for most urban and recreation uses. The hazard of flooding is the main limitation.

This soil is in capability subclass Vw.

17—Houston Black clay, 1 to 3 percent slopes. This is a gently sloping soil on uplands. The areas are irregular in shape and range from 20 to 2,500 acres in size.

Typically, this soil is moderately alkaline clay to a depth of about 64 inches. It is black in the upper 40 inches, and below that it is dark gray with brownish mottles. The underlying layer, between depths of 64 and 80 inches, is moderately alkaline shaly clay that has brownish, yellowish, and grayish mottles.

The soil is moderately well drained. Runoff is medium. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

Included in mapping are small areas of Heiden and Ferris soils. Also included are small areas of gently sloping Houston Black soils that have slopes of more than 3 percent. The included soils make up about 15 percent of most mapped areas.

This Houston Black soil is used mainly as cropland and pastureland. It has high potential for cotton, grain sorghum, and small grains. The residue from these crops should be left on the surface to help control erosion from water, improve water infiltration, and maintain the content of organic matter. Terracing and contour farming are needed to control erosion on this gently sloping soil. Grassed waterways may be needed to carry runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

This soil has high potential for pasture of bermudagrass and weeping lovegrass. The bermudagrass pasture is commonly overseeded with vetch and singletary peas. These plants add nitrogen to the soil, help control erosion, and provide grazing early in spring when the bermudagrass is dormant.

The soil has high potential for native grasses. It has medium potential for the development of habitat for wildlife.

The soil has low potential for most urban and recreation uses because it shrinks and swells with changes in moisture, is very slowly permeable, and has a clayey surface layer. These limitations are difficult and costly to overcome. However, through proper design and careful installation, this soil can be used for urban and recreation purposes.

This soil is in capability subclass IIe.

18—Kaufman clay, occasionally flooded. This is a nearly level soil on flood plains of streams. Slopes are less than 1 percent. The soil is protected from flooding by levees or flood prevention reservoirs. The areas range from about 40 to 400 acres in size.

Typically, the surface layer is neutral, very dark gray clay about 5 inches thick. Medium acid clay is between depths of 5 and 56 inches. It is very dark gray in the upper part and dark gray with dark yellowish brown mottles in the lower part. Neutral, dark gray clay that has dark yellowish brown mottles is between depths of 56 and 70 inches.

The soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard. In some areas this soil is flooded 1 or 2 times in an average 5-year period, depending on the degree of protection. It remains flooded for 1 to 3 days. In other areas the soil is flooded less often.

Included in mapping are small areas of Hopco and Tinn soils. These soils make up 5 to 20 percent of most mapped areas.

The Kaufman soil is used mainly as cropland and pastureland. It has high potential for cotton, grain sorghum, and small grains. The residue from these crops should be left on the surface to improve water infiltration and maintain the content of organic matter. Nitrogen and phosphorus fertilizer may be needed to increase yields.

The soil has high potential for pasture of bermudagrass and fescue. These grasses are commonly overseeded with legumes, for example, white clover and singletary peas.

The soil has high potential for native grasses. It has high potential for the development of habitat for wildlife.

This soil has low potential for most urban and recreation uses. The main limitations are the hazard of flooding, shrinking and swelling of the soil with changes

in moisture, very slow permeability, and a clayey surface layer.

This soil is in capability subclass IIw.

19—Kaufman clay, frequently flooded. This is a nearly level soil on flood plains along streams. Slopes are less than 1 percent. The areas are long and range from about 250 feet to 2 miles in width. They are as much as several thousand acres in size and generally cover an entire flood plain. Some areas are 60 to 300 acres in size and take in only part of a flood plain.

Typically, this soil is black clay to a depth of about 53 inches. It is mildly alkaline in the upper part and moderately alkaline in the lower part. The underlying layer between depths of 53 and 80 inches is slightly acid, very dark gray clay.

The soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard. This soil is flooded 1 to 5 times in most years and remains flooded 2 to 7 days after heavy rains.

Included in mapping are small areas of Hopco and Tinn soils. Also included are areas of Kaufman soils that are flooded only once or twice in an average 5-year period. These soils are in slightly higher positions than the frequently flooded Kaufman soil. The included soils make up 5 to 20 percent of most mapped areas.

This Kaufman soil is used mainly as pasture. It has high potential for pasture of bermudagrass or fescue overseeded with legumes, for example, white clover and singletary peas (fig. 5).

This soil has high potential for development of habitat for wildlife. It has high potential for native grasses (fig. 6).

This soil has low potential for use as cropland because of flooding and wetness. It has high potential for crops if flooding is controlled.

Figure 5.—Coastal bermudagrass and white clover in a pecan orchard. The soil is Kaufman clay, frequently flooded.

Figure 6.—Bales of eastern gamagrass hay in an area of Kaufman clay, frequently flooded.

This soil has low potential for most urban and recreation uses. The main limitations are the hazard of flooding, shrinking and swelling of the soil with changes in moisture, very slow permeability, and a clayey surface layer.

This soil is in capability subclass Vw.

20—Lamar loam, 5 to 12 percent slopes. This is a sloping to strongly sloping soil on side slopes of uplands above drainageways. The areas are irregular in shape, and range from about 20 to 400 acres in size.

Typically, this soil to a depth of about 36 inches is moderately alkaline loam. It is dark grayish brown in the upper part and light olive brown in the lower part. Below that, strata of variegated brownish and grayish loam, clay loam, and shaly clay extend to a depth of 50 inches.

This soil is well drained. Runoff is rapid. Permeability is moderate, and the available water capacity is medium. Water erosion is a severe hazard.

Included in mapping are small areas of Bazette soils, small areas of eroded Lamar soils, and gently sloping Lamar and Crockett soils. Also included are a few areas of Lamar soils that are underlain by thin, discontinuous limestone lentils at a depth of about 6 feet. The included soils make up 5 to 15 percent of most mapped areas.

This soil is used mainly as pasture, though it has low potential for pasture. It is suited to bermudagrass, weeping lovegrass, vetch, and singletary peas.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

This soil has medium potential for development of habitat for wildlife. It has medium potential for native grasses.

This soil has medium potential for most urban and recreation uses. Slope is the main limitation.

This soil is in capability subclass VIe.

21—Leson clay, 1 to 3 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from about 20 to 2,000 acres.

Typically, the surface layer is mildly alkaline, very dark gray clay about 28 inches thick. Below that, to a depth of 58 inches, the soil is moderately alkaline, dark grayish brown clay. The underlying material, to a depth of 72 inches, is moderately alkaline, mottled grayish brown, light gray, and light olive brown shaly clay.

The soil is moderately well drained. Runoff is medium. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

Included in mapping are small areas of Crockett and Wilson soils. Also included are small areas of Leson soils that have slopes of more than 3 percent. The included soils make up less than 15 percent of most mapped areas.

This soil is used mainly as cropland and pastureland. It has high potential for cotton, grain sorghum, and small grains (figs. 7 & 8). Crop residue should be left on the surface to help control erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming help control erosion on this gently sloping soil. Grassed waterways may be needed to carry runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

This soil has high potential for bermudagrass and weeping lovegrass. Bermudagrass pastures may be overseeded with vetch and singletary peas. These plants add nitrogen to the soil and provide grazing early in spring while the bermudagrass is dormant.

This soil has medium potential for use as wildlife habitat. It has high potential for producing native grasses.

This soil has low potential for most urban and

Figure 7.—Cotton and wheat on Leson clay, 1 to 3 percent slopes.

Figure 8.—Grain sorghum and cotton in a terraced field with grassed waterways. The soil is Leson clay, 1 to 3 percent slopes.

recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations (fig. 9). These limitations are difficult and costly to overcome. However, through proper design and careful installation, the soil can be used for urban and recreation purposes.

This soil is in capability subclass IIe.

22—Leson clay, 3 to 5 percent slopes. This is a gently sloping soil on side slopes of uplands above drainageways. Individual areas are long and narrow in shape and range from about 20 to 70 acres in size.

Typically, the surface layer is neutral, black clay about 6 inches thick. The layer below that extends to a depth of 20 inches. It is neutral, very dark gray clay. To a depth of 42 inches the soil is moderately alkaline clay that is very dark grayish brown in the upper part and grades to olive in the lower part. The substratum extends to a depth of 70 inches. It is moderately alkaline, variegated grayish and brownish shale and shaly clay.

The soil is moderately well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. Water erosion is a moderate hazard.

Included in mapping are small areas of Ferris and

Heiden soils. The included soils make up less than 15 percent of most mapped areas.

This soil is used mainly as pastureland and cropland. It has medium potential for bermudagrass and weeping lovegrass. It is well suited to vetch and singletary peas. These legumes add nitrogen to the soil and help prevent erosion.

This soil has medium potential for cotton, grain sorghum, and small grains. Crop residue should be left on the surface to help control water erosion, increase water infiltration, and maintain the content of organic matter. Terracing and contour farming help control erosion on this gently sloping soil. Grassed waterways may be necessary to carry runoff from terraces. Nitrogen and phosphorus may be needed to increase yields.

This soil has medium potential for use as wildlife habitat. It has high potential for producing native grasses.

This soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and installation, this soil can safely be used for urban and recreation purposes.

This soil is in capability subclass IIIe.

23—Leson-Urban land complex, 1 to 3 percent slopes. This complex consists of a gently sloping soil

Figure 9.—Changes in moisture content cause clayey soils to shrink and swell, resulting in large cracks during dry periods. The soil is Leson clay, 1 to 3 percent slopes.

and Urban land on uplands. Individual areas are oblong or irregular in shape and range from about 40 to 1,500 acres in size.

Leson clay makes up 35 to 60 percent of this complex, Urban land makes up 25 to 50 percent, and other soils make up as much as 15 percent. Areas of each are so intricately mixed that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Leson soil is mildly alkaline, very dark gray clay about 28 inches thick. Below that, to a depth of 58 inches, the soil is moderately alkaline, dark grayish brown clay. The underlying material, to a depth of 72 inches, is moderately alkaline, mottled grayish brown, light gray, and light olive brown shaly clay.

The Leson soil is moderately well drained. Runoff is medium. Permeability is very slow, and the available water capacity is high.

In areas of Urban land, dwellings, streets and highways, commercial buildings, and other structures cover the soils, or the soils have been altered by cutting, filling, or grading to the point that classification is not practical.

Included with this complex in mapping are small areas of Crokett and Wilson soils.

The Leson soil has low potential for most urban and recreation uses. The shrink-swell potential, very slow permeability, and clayey surface layer are limitations. These limitations are difficult and costly to overcome. However, through proper design and installation, the soils can be used for urban and recreation purposes.

This unit is not assigned to a capability subclass.

24—Lufkin-Rader complex. This complex consists of nearly level soils on old terraces. Slopes are less than 1 percent. Individual areas are irregular in shape and range from 50 to about 500 acres in size. The surface is uneven. Circular to elongated mounds that are 1 to 3 feet high are interspersed among concave areas. The circular mounds are 20 to 100 feet in diameter, and the elongated mounds are 30 to 300 feet long and 10 to 80 feet wide.

This complex is 50 to 60 percent Lufkin loam, 25 to 40 percent Rader loam and 5 to 15 percent other soils. The intermound areas are mainly Lufkin soils, and the mounds are mainly Rader soils. These soils are in patterns too intricate to allow separate mapping of the soils at the scale used.

Typically the surface layer of the Lufkin soil is slightly acid, grayish brown loam about 4 inches thick. Below that, to a depth of 8 inches, the soil is medium acid, light brownish gray loam. To a depth of 25 inches, it is very strongly acid, grayish brown clay. To a depth of 50 inches, the soil is slightly acid, dark grayish brown clay. To a depth of 74 inches, it is mildly alkaline, light brownish gray clay. To a depth of 80 inches, it is neutral, light olive gray clay with brownish mottles.

This Lufkin soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is medium. Water erosion is a slight hazard.

Typically, the surface layer of the Rader soil is slightly acid, brown loam about 6 inches thick. Below that, to a depth of 11 inches, the soil is very strongly acid, yellowish brown loam. To a depth of 20 inches, it is very strongly acid, strong brown loam. To a depth of 27 inches it is very strongly acid, mottled yellowish red, red, and brown clay loam that has streaks and pockets of light gray uncoated sand. To a depth of about 80 inches, the soil is strongly acid clay that is mottled gray and red in the upper part and grades to light brownish gray in the lower part.

This Rader soil is moderately well drained. Runoff is slow. Permeability is very slow, and the available water capacity is medium. Water erosion is a slight hazard.

Included in mapping are small areas of Axtell soils. Also included are soils that are similar to Lufkin and Rader soils. The included soils make up 5 to 15 percent of most mapped areas.

These soils are used mainly as pasture. The potential for pasture is medium. Bermudagrass and bahiagrass are the main grasses. The soil is well suited to vetch and singletary peas. These legumes add nitrogen to the soil and provide grazing early in spring.

These soils have low potential for use as cropland. They are suited to grain sorghum and small grains. Crop residue should be left on the surface to increase water infiltration and maintain the content of organic matter. Drainage may be needed on these soils if they are cultivated. Lime, nitrogen, phosphorus, and potassium may be needed to increase yields.

These soils have high potential for use as wildlife habitat. They have low potential for producing native grasses.

These soils have low potential for most urban and recreation uses. The very slow permeability, shrink-swell potential, and seasonal wetness are limitations. These limitations are difficult and costly to overcome. Appropriate design and careful installation are essential.

This complex is in capability subclass IIIw.

25—Nahatche loam, frequently flooded. This is a nearly level soil on flood plains of streams. Slopes are less than 1 percent. Individual areas are dominantly long and narrow, 100 feet to one-half mile wide, and 40 to 400 acres in size.

Typically, the surface layer is about 4 inches thick. It is medium acid, dark grayish brown loam that has strong brown mottles. Below that, to a depth of 9 inches, the soil is medium acid, brown loam that has dark yellowish brown and strong brown mottles. To a depth of 37 inches, it is slightly acid clay loam that is dark grayish brown in the upper part and mottled gray and brown in the lower part. The underlying material to a depth of 60 inches is neutral, grayish brown sandy clay loam that has yellowish brown mottles.

This soil is somewhat poorly drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. Water erosion is a slight hazard. A water table is usually within 20 inches of the surface in winter and spring. The soil is flooded 2 to 5 times in most years and remains flooded for 1 to 4 days after heavy rains.

Included in mapping are small areas of Kaufman and Hopco soils. Some areas of soils similar to Nahatche soils are also included. Some of the soils are slightly wetter than Nahatche soils. Others have a thin, dark colored surface layer. The included soils make up 10 to 25 percent of most areas and as much as 40 percent of some mapped areas.

This soil is used mainly as pastureland. It has high potential for use as pastureland. Bermudagrass, fescue, and bahiagrass are commonly grown. The soil is well suited to white clover and singletary peas. Lime, nitrogen, phosphorus, and potassium may be needed to increase production.

This soil has high potential for use as wildlife habitat. It has medium potential for native grass production.

This soil is not suited to cultivation. The hazard of flooding and wetness are limitations. If flooding is controlled, the potential for cropland is medium.

This soil has low potential for most urban and recreation uses. Flooding is the main limitation.

This soil is in capability subclass Vw.

26—Pits. This map unit consists of areas from which rock, clay, and sand have been excavated. The resulting pits range from about 6 to 75 acres in size. On the maps, the smaller pits are indicated by a pick and shovel symbol.

The rock pits are located around Lake Tawakoni and in the Wolfe City and Celeste areas. Those around Lake Tawakoni are the largest. They are 20 to 40 feet deep. The pits are dug to remove limestone. Pits have been dug to remove chalk in areas of Stephen, Dalco, and Fairlie soils. Those pits are about 3 to 12 feet deep. The limestone and chalk are crushed and used mainly for roads. Some of the rock pits contain water throughout the year.

Most of the clay pits are in areas of Axtell soils along Interstate 30. The clay is used as fill material in highway construction.

Sand pits are in areas of Gasil and Rader soils throughout the eastern and southern parts of the survey area. Most of these pits are less than 6 feet deep. The sand is used mainly as topsoil on yards and in other landscaped areas.

This unit is not assigned to a capability subclass.

27—Rader fine sandy loam, 1 to 3 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from about 15 to 75 acres in size.

Typically, the surface layer is medium acid, brown fine sandy loam about 8 inches thick. Below that, to a depth of 22 inches, the soil is slightly acid, brown sandy clay loam that has streaks and pockets of grayish brown fine sandy loam. To a depth of 70 inches, it is strongly acid, mottled gray, yellowish brown, and dark red sandy clay. To a depth of 80 inches, the soil is strongly acid, yellowish brown sandy clay loam that has gray and red mottles.

The soil is moderately well drained. Runoff is slow. Permeability is very slow, and the available water capacity is medium. Water erosion is a slight hazard. A water table is usually within 40 inches of the surface in winter and spring.

Included in mapping are small areas of Lufkin and Axtell soils. The Lufkin soils are in small depressed areas. The Axtell soils are on narrow ridgetops and small eroded spots. The included soils make up 3 to 15 percent of most mapped areas.

This soil is used mainly as pastureland. It has high potential for bermudagrass, bahiagrass, and weeping lovegrass. Bermudagrass pastures may be overseeded with vetch, clover, and singletary peas. These legumes add nitrogen to the soil and provide grazing early in spring while the bermudagrass is dormant.

This soil has medium potential for field peas, grain sorghum, small grains, and corn. Terracing and contour farming are usually needed to control erosion on this gently sloping soil. Lime, nitrogen, phosphorus, and potassium may be needed to increase yields.

The soil has medium potential for producing native grasses. It has high potential for use as wildlife habitat.

This soil has medium potential for most urban and recreation uses. The seasonal high water table and very slow permeability are the main limitations. This soil is an excellent source of topsoil.

This soil is in capability subclass IIIs.

28—Stephen silty clay, 2 to 5 percent slopes. This is a gently sloping soil on narrow ridgetops and side slopes of uplands above drainageways. Individual areas are irregular in shape and range from about 10 to 40 acres in size.

Typically, the surface layer is moderately alkaline silty clay about 12 inches thick that is very dark grayish brown in the upper part and dark grayish brown in the lower part. The layer below that extends to a depth of 17 inches and is dominantly partly weathered chalk fragments interbedded with silty clay. The substratum is white platy chalk.

This soil is well drained. Runoff is medium to rapid. Permeability is moderately slow, and the available water capacity is very low. Water erosion is a moderate hazard.

Included in mapping are small areas of Dalco soils. The included soils make up about 10 percent of most mapped areas. A few shallow gullies are included in most areas.

This soil is used mainly as pasture. It has low potential for improved pasture. It is suited to grasses, including bermudagrass, lovegrass, and kleingrass, and legumes, including vetch, singletary peas, and button clovers.

This soil has low potential for use as cropland. The shallowness to bedrock and the hazard of erosion are the main limitations (fig. 10).

This soil has low potential for native grasses. It has medium potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The shallowness to bedrock and the clayey surface layer are limitations.

This soil is in capability subclass IVe.

29—Tinn clay, occasionally flooded. This is a nearly level soil on flood plains of streams. Slopes are less than 1 percent. The soil is protected from flooding by levees or flood prevention reservoirs. Individual areas range from about 40 to 400 acres in size.

Typically, the surface layer is moderately alkaline, very dark gray clay about 4 inches thick. Below that, to a depth of 36 inches, the soil is moderately alkaline, black clay that has olive gray mottles and streaks. To a depth of 60 inches, it is moderately alkaline, black clay.

The soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard. In some areas, this soil is flooded once or twice in most 5-year periods and remains flooded for 1 to 3 days. In other more protected areas the soil is flooded less often.

Included in mapping are small areas of Hopco and Kaufman soils. The included soils make up 5 to 20 percent of most mapped areas.

This soil is used mainly as cropland and pastureland. It has high potential for cotton, grain sorghum, and small grains. Crop residue should be left on the surface to increase water infiltration and maintain the content of organic matter. Nitrogen and phosphorus may be needed to increase yields.

This soil has high potential for bermudagrass and fescue in combination with legumes such as white clover and singletary peas.

The soil has high potential for producing native grasses. It has high potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The hazard of flooding, shrink-swell potential, very slow permeability, and clayey surface layer are limitations.

This soil is in capability subclass IIw.

30—Tinn clay, frequently flooded. This is a nearly level soil on flood plains of streams. Slopes are less than 1 percent. The areas are long and are 200 feet to 1 mile wide. They range from 400 to 2,000 acres in size

Figure 10.—The white areas in this recently planted field are exposed chalk. The soil is Stephen silty clay, 2 to 5 percent slopes.

Figure 11.—Cotton in an area of Wilson silt loam, 0 to 1 percent slopes.

and generally take in an entire flood plain. Some areas are 60 to 300 acres in size and take in only part of a flood plain.

Typically, the surface layer is moderately alkaline, black clay about 26 inches thick. Below that, to a depth of 39 inches, the soil is moderately alkaline, black clay that has very dark gray mottles. To a depth of 76 inches, it is moderately alkaline, black clay.

The soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard. This soil is flooded 1 to 5 times in most years and remains flooded for 2 to 5 days after heavy rains.

Included in mapping are small areas of Hopco and Kaufman soils. Also included are small areas of Tinn soils that are flooded only once or twice in most 5-year periods. These soils are in slightly higher positions on the landscape than the frequently flooded Tinn soil. Also included are areas of Tinn soils that are underlain by chalk at a depth of more than 5 feet. These soils are on flood plains that are associated with the Fairlie, Dalco, and Stephen soils. The included soils make up 5 to 20 percent of most mapped areas.

This soil is used mainly as pasture. It has high potential for bermudagrass and fescue combined with legumes such as white clover and singletary peas. Nitrogen and phosphorus may be needed to increase yields.

This soil has low potential for use as cropland because of flooding and wetness. If flooding is controlled, the soil has high potential for use as cropland.

The soil has high potential for native grasses. It has high potential for use as wildlife habitat.

This soil has low potential for most urban and recreation uses. The hazard of flooding, shrink-swell potential, very slow permeability, and a clayey surface layer are limitations.

This soil is in capability subclass Vw.

31—Wilson silt loam, 0 to 1 percent slopes. This is a nearly level soil on old terraces. Individual areas are mainly 50 to 500 acres in size but range from 15 to 1,200 acres. The smaller areas are generally oval, and the larger areas are broad and irregular in shape.

Typically, the surface layer is medium acid, dark

grayish brown silt loam about 6 inches thick. Below that, clay extends to a depth of 64 inches. It is slightly acid and very dark gray in the upper part, neutral and black in the middle part, and neutral and dark grayish brown in the lower part. To a depth of 80 inches, the soil is light gray silty clay.

This soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

Included in mapping are small areas of Burleson and Crockett soils and areas of gently sloping Wilson soils. The included soils make up about 5 to 25 percent of most mapped areas.

This soil is used mainly as cropland and pasture. It has medium potential for cotton, grain sorghum, and small grains (fig. 11). Crop residue should be left on the surface to increase water infiltration and to maintain the content of organic matter. Nitrogen, phosphorus, and potassium may be needed to increase yields.

This soil has medium potential for bermudagrass and bahiagrass. Bermudagrass pasture may be overseeded with vetch and singletary peas. These legumes add nitrogen to the soil and provide grazing early in spring while the bermudagrass is dormant.

The soil has medium potential for use as wildlife habitat. It has medium potential for producing native grasses.

The potential for most urban and recreation uses is low. The shrink-swell potential, very slow permeability, and wetness are the main limitations. These limitations are difficult and costly to overcome. Appropriate design and careful installation are essential.

This soil is in capability subclass IIIw.

32—Wilson-Urban land complex, 0 to 1 percent slopes. This complex consists of a nearly level soil and Urban land on old terraces mainly on the fringe of areas of urban expansion. Individual areas are irregular in shape and range from about 30 to 200 acres in size.

Wilson silt loam makes up 45 to 70 percent of the complex. Urban land makes up 20 to 45 percent, and other soils make up as much as 10 percent. The areas of the components are so intricately mixed that it was not practical to separate them at the scale of mapping used for this survey.

Typically, the surface layer of the Wilson soil is medium acid, dark grayish brown silt loam about 6 inches thick. Below that, to a depth of 64 inches, the soil is clay that is slightly acid and very dark gray in the upper part, neutral and black in the middle part, and neutral and dark grayish brown in the lower part. To a depth of 80 inches, the soil is moderately alkaline, light gray silty clay.

This soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is high. Water erosion is a slight hazard.

In areas of Urban land, the soils are covered by dwellings, streets, parking lots, commercial buildings, and other structures, including the Greenville airport. In other areas, the soils have been altered by cutting, filling, and grading to the point that classification is not practical.

Included in mapping are small areas of Burleson and Crockett soils.

The Wilson soil has low potential for most urban and recreation uses. The main limitations are very slow permeability, wetness, and shrink-swell potential. These limitations are difficult and costly to overcome. However, through appropriate design and careful installation of structures, the soil can be used for urban and recreation purposes.

This unit is not assigned to a capability subclass.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, approximately 409,000 acres in the survey area was used for crops and pasture, according to the Conservation Needs Inventory (*3*). Of that total, 146,000 acres was used for permanent pasture; 64,000 acres for row crops, mainly cotton and grain sorghum; 60,000 acres for close-growing crops, mainly wheat and oats; and 17,000 acres for hay crops. The rest was temporarily idle cropland and cropland in grasses, legumes, or small grains used as cover crops.

Acreage in crops and pasture has gradually been decreasing as more land is used in urban development. In 1967, about 30,000 acres in the county was urban and built-up land. Since then, the acreage has been increasing at the rate of about 1,000 acres per year.

The soils in Hunt County have good potential for increased production of food. About 125,000 acres of potentially good cropland is currently idle or is being used as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop-production technology to all cropland in the county.

Soil erosion is the major concern on most of the cropland and pasture in Hunt County. If the slope is more than 1 percent, erosion is a hazard.

Erosion of the surface layer results in reduced productivity. Loss of the surface layer is especially damaging to loamy soils that have a clayey subsoil, for example, Axtell and Crockett soils, because part of the subsoil is incorporated into the plow layer. Loss of the surface layer is also damaging to soils that are underlain by chalk, for example, Dalco, Fairlie, and Stephen soils.

In many areas of gently sloping soils, tilling or preparing a good seedbed is difficult because the original friable surface layer has been eroded away and clayey spots are exposed. Clayey spots are common in eroded areas of Crockett soils.

Soil erosion also results in the sedimentation of streams. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide a protective cover on the surface, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of

the soils. On livestock farms, the legume and grass forage crops in the cropping system reduce erosion on gently sloping soils and also provide nitrogen and improve tilth for the crop that follows.

Terraces and diversions reduce the length of the slope and help to control runoff and erosion. Heiden, Houston Black, and Leson soils and, in places, Fairlie and Dalco soils are suitable for terraces. The other soils in the county are less suitable for terraces and diversions because of a clayey subsoil that would be exposed in terrace channels or chalk at a depth of less than 40 inches.

Contouring and crop residue management are in widespread use in the county. These practices control erosion by reducing the impact of raindrops and allowing water to move off the field at a slower, less erosive velocity. Crop residue management contributes to good tilth, especially on loamy soils, such as Crockett and Wilson soils, which tend to be hard and massive when dry.

Information on erosion control practices for each kind of soil in the county is available at local offices of the Soil Conservation Service.

Fertility is naturally low in most loamy soils on uplands in the survey area. The soils on flood plains, for example, Hopco, Kaufman, and Tinn soils, and the clayey soils on uplands, for example, Dalco, Fairlie, Heiden, Houston Black, and Leson soils, are less acid and naturally have a higher content of plant nutrients than do the loamy soils on uplands. On all soils, additions of lime and fertilizer should be based on the results of soil tests, the needs of the crop, and the expected level of yields. The Texas Agricultural Extension Service can help in determining the kind and amount of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that are granular and porous have good tilth.

Most of the soils in the survey area that are used for crops have a surface layer of clay. Generally, the structure of such soils is weak or moderate. Regular additions of crop residue, manure, and other organic material help to maintain or improve soil structure. Tilth is a concern on clayey soils because they often stay wet until late in spring. If they are plowed when wet, they tend to be cloddy when dry, making a good seedbed difficult to prepare. Fall plowing on such soils generally results in good tilth in the spring.

Field crops that are suited to the soils and climate of Hunt County include many that are not now commonly grown but could be grown if economic conditions were favorable. The latest information and suggestions for growing special crops can be obtained from local offices of the Texas Agricultural Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for pasture, for wildlife habitat or for engineering purposes.

In the capability system, soils are generally grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use. (None in the county.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation. (None in the county.)

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. (None in the county.)

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. All soils in the survey area are included except Pits and complexes that include Urban land. The capability classification of each map unit is given in the section "Detailed soil map units."

native grazing land

Prior to settlement of the area, most of what is now Hunt County supported a plant community dominated by grasses. The Crockett, Dalco, Fairlie, Ferris, Heiden, Houston Black, Leson, and Wilson soils formed under native grass vegetation. In most areas, these soils have been cultivated or used for improved pasture. Most of the areas that have remained in native grasses are small and are scattered throughout the county. Income derived from grazing and haying in these areas is small compared to that from other farm enterprises.

The native grazing land in some areas has been greatly depleted by overgrazing. Some of the acreage that was once open grassland is now covered with invading brush and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of native grazing land can be increased by using appropriate management practices.

In areas that have similar climate and topography, differences in the kind and amount of vegetation that can be produced are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for each soil, the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to native grazing land are listed. Explanation of the column headings in table 8 follows.

Total production is the amount of vegetation that can be expected to grow annually on well managed areas that are supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present condition of the native grazing land. The condition is determined by comparing the present plant community with the potential natural plant community on a particular soil. The more closely the existing community resembles the potential community, the better the condition. Condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in management of native grazing land is to control grazing so that the plants growing on a soil are about the same in kind and amount as the potential natural plant community for that soil. Such management

generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is firm after rains and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Frank Sprague, biologist, Soil Conservation Service, helped prepare this section.

The wildlife resources of Hunt County are largely influenced by agricultural activities and cultivation. The county has been intensively farmed for many years. Wooded belts along streams provide cover for a variety of wildlife species, including mourning dove, quail, squirrel, and rabbit. Ducks are common on farm ponds during migration periods. Raccoon, skunk, opossum and other furbearers are common along streams and rivers. Coyotes have increased in the county during recent years. Most farm ponds in the county have been stocked with largemouth bass, channel catfish, and sunfish.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair*

indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bermudagrass, clover, and winter pea.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, hard-seeded paspalum and panic grasses, sunflower, croton, western ragweed, and common broomweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, pecan, black walnut, elm, hackberry, hawthorn, and osage orange. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are cedar and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, and soil moisture. Examples of shrubs are green brier, honeysuckle, and dewberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, and slope. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, hawks, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for wildlife on native grazing land consists of areas on the few fertile prairies remaining in the county that support stands of native grasses and related plants. The areas are used for grazing and as native hay meadows. Wildlife attracted to these areas included coyote, bobwhite quail, dove, eastern meadowlark, horned lark, hawks, and songbirds.

engineering

Joe T. Rogers, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the

content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Bedrock interferes with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, and flooding.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope and bedrock can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, and slopes of 12 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, or slopes of 12 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 13 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They have slopes of less than 8 percent, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, or soils that have slopes of 8 to 12 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Wetness, slope, and depth to bedrock affect the construction of grassed waterways. Low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture (*5*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep

or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain sediments, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that is not so wet as the central (typic) concept of the Fluvaquents and is an example of an intergrade. An example is Aeric Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, thermic Aeric Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Nahatche series, a member of the fine-loamy, mixed, nonacid, thermic family of Aeric Fluvaquents.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Axtell series

The Axtell series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in loamy and clayey sediment under a plant community of mixed hardwoods and native grasses. Slopes range from 2 to 12 percent.

Typical pedon of Axtell loam, 2 to 5 percent slopes; 6.4 miles east and north on Farm Road 2101 from its intersection with Texas Highway 34 about 12 miles south

of Greenville, 1.6 miles east on Farm Road 2947, 0.3 mile east on paved road, 0.5 mile south on private road, and 0.5 mile southwest, in a pasture:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam; weak fine and medium subangular blocky structure; hard, very friable; many fine and medium roots; slightly acid; clear smooth boundary.
A2—4 to 8 inches; light yellowish brown (10YR 6/4) loam; weak fine subangular blocky structure; hard, very friable; common fine and medium roots; slightly acid; abrupt wavy boundary.
B21t—8 to 15 inches; yellowish red (5YR 4/6) clay; common fine and medium red (2.5YR 4/6), brown (10YR 5/3), and grayish brown (10YR 5/2) mottles; moderate fine and medium blocky structure; extremely hard, very firm; common fine and few coarse roots; continuous clay films on surface of peds; very strongly acid; clear wavy boundary.
B22t—15 to 22 inches; mottled grayish brown (10YR 5/2) and dark red (2.5YR 3/6) clay; weak coarse blocky structure; extremely hard, very firm; common fine and few medium roots; few slickensides; continuous clay films on surface of peds; strongly acid; gradual wavy boundary.
B23t—22 to 34 inches; light brownish gray (2.5Y 6/2) clay; common fine and medium yellowish red (5YR 5/8) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse blocky; extremely hard, very firm; common very fine and few medium roots; few slickensides; clay films on surface of most peds; few fine black concretions; strongly acid; gradual wavy boundary.
B24t—34 to 53 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown mottles; weak coarse prismatic structure parting to weak coarse blocky; very hard, firm; few very fine and medium roots; few slickensides; clay films on surface of some peds; few fine black concretions; few fine masses of neutral salts; slightly acid; gradual wavy boundary.
B3—53 to 80 inches; light brownish gray (2.5Y 6/2) sandy clay loam; common fine distinct olive yellow mottles; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, firm; few fine and medium roots; few patchy clay films on surface of peds; few fine masses of neutral salts; few gypsum crystals; few streaks of uncoated sand; mildly alkaline.

The depth to the subsoil varies within short distances. If the A horizon were removed there would be a series of highs and lows in the subsoil, which are referred to here as crests and troughs.

The solum is 50 to more than 70 inches thick.

The A1 or Ap horizon is very dark grayish brown, dark grayish brown, brown, or pale brown. The A2 horizon is dark grayish brown, grayish brown, brown, light yellowish brown, pale brown, or very pale brown. The A horizon is fine sandy loam or loam. It is less than 8 inches thick in more than 50 percent of the pedon but is as much as 15 inches thick over some troughs. Reaction is strongly acid through slightly acid. The boundary between the A and the Bt horizons is abrupt and wavy where the subsoil crests and is clear and smooth where there are troughs.

The B2t horizon is red, dark red, reddish brown, yellowish red, brown, strong brown, or light brownish gray. It is commonly mottled with these colors and various other shades of red, brown, and gray. It is clay, clay loam, or sandy clay. Reaction is very strongly acid through neutral.

The B3 horizon is light brownish gray, yellowish brown, or gray with mottles in these colors and in various other shades of red, yellow, brown, and gray. It is sandy clay loam, clay loam, or clay. Reaction is medium acid through moderately alkaline.

In some pedons there is a C horizon, which consists of layers of variegated gray and brown shaly clay, clay loam, and sandy clay loam. Reaction is medium acid through moderately alkaline. There are few concretions of calcium carbonate and few black concretions in some of these pedons.

Bazette series

The Bazette series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in alkaline clayey sediment under a mixed hardwood and native grass plant community. Slopes range from 5 to 12 percent.

Typical pedon of Bazette clay loam, 5 to 12 percent slopes; from the intersection of Farm Road 1571 and Farm Road 513 in Lone Oak, 4.0 miles south on Farm Road 513, 0.15 mile west on private road, 0.15 mile north by northwest on private road, and 50 feet north, in a pecan orchard:

A1—0 to 6 inches; very dark grayish brown (2.5Y 3/2) clay loam; moderate fine and medium subangular blocky structure; very hard, friable; many fine and very fine roots; few pores; few worm casts; few fine chert pebbles; neutral; clear smooth boundary.
B21t—6 to 12 inches; olive brown (2.5Y 4/4) clay loam; very dark grayish brown (2.5Y 3/2) coatings on surface of some peds; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; few pores; few worm casts; neutral; gradual smooth boundary.
B22t—12 to 24 inches; light olive brown (2.5Y 5/4) clay; olive brown (2.5Y 4/4) coatings on surface of some peds; moderate medium subangular blocky structure; very hard, firm; few fine roots; common pores; common worm casts; neutral; gradual smooth boundary.
B3ca—24 to 39 inches; light olive brown (2.5Y 5/4) clay loam; few fine faint grayish brown mottles; weak

medium subangular blocky structure; very hard, firm; few fine roots; few pores; few worm casts; common soft masses and few concretions of calcium carbonate; few fine chert pebbles; calcareous; moderately alkaline; gradual smooth boundary.

C—39 to 60 inches; variegated light yellowish brown (2.5Y 6/4) and grayish brown (2.5Y 5/2) clay loam and shale; massive; very hard, firm; few very fine roots; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 25 to 45 inches thick. The depth to layers containing secondary calcium carbonate ranges from 24 to 60 inches.

The A horizon is very dark grayish brown, dark brown, brown, or dark grayish brown. It is loam or clay loam and is 4 to 8 inches thick. Reaction is medium acid through neutral.

The B2t horizon is yellowish brown, olive brown, light olive brown, or olive yellow. In some pedons there are few to common mottles in those colors. Texture is clay loam, silty clay loam, silty clay, or clay; the clay content is 35 to 45 percent. Reaction is medium acid through neutral.

The B3 horizon is light olive brown, olive yellow, or olive brown, or is mottled in those colors and in other shades of brown. Texture is clay loam or clay. In some pedons there is a B3ca horizon that is 10 to 20 percent visible carbonates. Reaction is slightly acid through moderately alkaline.

The C horizon consists of layers of variegated brown, yellow, olive, and gray shaly clay, shale, and loamy soil material. Reaction is slightly acid through moderately alkaline.

Branyon series

The Branyon series consists of deep, moderately well drained, clayey soils on terraces. These soils formed in calcareous clays under a prairie grass plant community. Slopes are 0 to 1 percent.

Typical pedon of Branyon clay, 0 to 1 percent slopes; 1.5 miles west on U.S. Highway 380 from its intersection with Farm Road 36 in Floyd, 0.5 mile north on county line road, 0.35 mile east, and 0.3 mile north on county road, and 0.55 mile east in a cultivated field:

Ap—0 to 7 inches; black (10YR 2/1) clay; moderate medium subangular blocky structure parting to moderate fine and very fine granular; very hard, very firm; few fine and medium roots; few concretions of calcium carbonate; few medium chert pebbles; calcareous; moderately alkaline; clear smooth boundary.

A1—7 to 53 inches; black (5Y 2/1) clay; moderate medium blocky structure; extremely hard, extremely firm; common intersecting slickensides; few fine roots; few fine black concretions; few concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

AC—53 to 68 inches; dark gray (10YR 4/1) clay; few medium faint very dark gray (10YR 3/1) and few fine distinct yellowish brown mottles; weak coarse blocky structure; extremely hard, extremely firm; few fine roots; common intersecting slickensides; few fine black and brown concretions; common concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 100 inches thick. Intersecting slickensides begin at a depth of about 6 inches. When the soil is dry, cracks 1 to 3 inches wide extend to a depth of 20 inches or more. Cycles of microknolls and microdepressions are repeated each 10 to 20 feet. Most horizons have a few black concretions and concretions of calcium carbonate.

The A horizon is black, very dark gray, or dark gray. In some pedons it has mottles in those colors.

The AC horizon is dark gray, gray, or grayish brown with few to common mottles of yellowish brown, dark yellowish brown, light olive brown, and very dark gray.

Burleson series

The Burleson series consists of deep, moderately well drained, clayey soils on terraces. These soils formed in alkaline clays under a prairie grass plant community. Slopes are 0 to 1 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Farm Road 36 and Texas Highway 66 in Caddo Mills, 1.0 mile southwest on Texas Highway 66, 2.1 miles south on Farm Road 1565, 1.0 mile west on county road, and 50 feet south, in a microdepression in a cultivated field:

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay; moderate fine and very fine subangular blocky structure; extremely hard, very firm; few fine and medium roots; few very fine black concretions; slightly acid; clear smooth boundary.

A1—5 to 40 inches; very dark gray (10YR 3/1) clay; weak medium and coarse blocky structure; extremely hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds; few fine black concretions; neutral; gradual wavy boundary.

AC1—40 to 66 inches; dark gray (10YR 4/1) clay; weak coarse blocky structure; extremely hard, very firm; few fine roots; common intersecting slickensides that form wedge-shaped peds; few fine black concretions; few pitted concretions of calcium carbonate; mildly alkaline; gradual wavy boundary.

AC2—66 to 80 inches; gray (10YR 5/1) clay, few coarse faint grayish brown (10YR 5/2) and common fine distinct yellowish brown mottles; weak coarse blocky structure; extremely hard, very firm; few fine roots;

common intersecting slickensides that form wedge-shaped peds; few fine black concretions; few concretions of calcium carbonate; moderately alkaline.

The solum is 60 to more than 100 inches thick. Intersecting slickensides begin at a depth of about 20 inches. When the soil is dry, cracks 1 to 3 inches wide extend to a depth of 20 inches or more. Cycles of microknolls and microdepressions are repeated each 10 to 20 feet. A few black concretions are in most horizons.

The A horizon is very dark gray, dark gray, or black. Reaction is slightly acid through mildly alkaline.

The AC horizon is dark gray, gray, dark grayish brown, grayish brown, or light brownish gray with few to many mottles in shades of brown, gray, or yellow. It is mildly alkaline or moderately alkaline but is typically noncalcareous. There are few to common concretions of calcium carbonate in the lower part.

Crockett series

The Crockett series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in alkaline shaly clay under a prairie grass plant community. Slopes range from 1 to 5 percent.

Typical pedon of Crockett loam, 1 to 3 percent slopes; from the intersection of Farm Road 36 and Farm Road 2194 in Merit, 1.95 miles east on Farm Road 2194, 0.85 mile north on county road, and 140 feet east, in a pasture:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam; weak fine and very fine subangular blocky structure; hard, friable; common fine and few medium roots; few fine black concretions; few fine chert pebbles; medium acid; abrupt wavy boundary.

B21t—7 to 12 inches; dark reddish brown (2.5YR 3/4) clay, very dark grayish brown (10YR 3/2) coatings on surface of peds; moderate fine and medium subangular blocky structure; extremely hard, very firm; common fine and few medium roots; few intersecting slickensides; few fine black concretions; slightly acid; clear wavy boundary.

B22t—12 to 22 inches; mottled yellowish brown (10YR 5/4), dark grayish brown (10YR 4/2), and reddish brown (5YR 4/4) clay; weak fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few intersecting slickensides; clay films on surface of some peds; few fine black concretions; slightly acid; gradual wavy boundary.

B23t—22 to 41 inches; dark grayish brown (2.5Y 4/2) clay; few fine distinct yellowish brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; few very fine roots; few intersecting slickensides; clay films on surface of some peds; few fine black concretions; mildly alkaline; gradual wavy boundary.

B3—41 to 53 inches; light olive brown (2.5Y 5/4) clay; few fine faint yellowish brown mottles; weak coarse blocky structure; extremely hard, very firm; few very fine roots; few slickensides; common soft masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—53 to 65 inches; variegated and mottled light brownish gray (10YR 6/2), light gray (10YR 7/2), dark gray (10YR 4/1), and olive (5Y 5/6) shaly clay; massive; extremely hard, very firm; few very fine roots; few fine black concretions; few concretions of calcium carbonate; moderately alkaline.

The depth to the subsoil varies within short distances. If the A horizon were removed there would be a series of highs and lows in the subsoil, which are referred to here as crests and troughs.

The solum is 40 to about 60 inches thick. Secondary carbonates are at a depth of 30 to 60 inches.

The A horizon is dark grayish brown, brown, dark brown, or very dark grayish brown. Texture is loam or fine sandy loam. This horizon is less than 10 inches thick on the average. It is as much as 15 inches thick over troughs. The boundary between the A and Bt horizon is abrupt and wavy where the subsoil crests and is clear and smooth where there are troughs. Reaction is medium acid through neutral.

The color of the B21t horizon is extremely variable within a distance of a few feet. In some pedons the B21t horizon has a matrix of dark reddish brown, reddish brown, olive brown, or brown and has few to common mottles of dark gray, dark grayish brown, very dark grayish brown, red, and reddish brown. In other pedons, it has no matrix color and is prominently mottled. The clay content in the upper 20 inches of the Bt horizon ranges from 40 to 55 percent. Reaction is medium acid or slightly acid.

The B22t horizon and the B horizons below that are dark grayish brown, olive brown, light olive brown, or very dark grayish brown, with few to many mottles of olive yellow, yellowish brown, dark yellowish brown, grayish brown, gray, reddish brown, and light yellowish brown. Texture is clay or sandy clay. There are few to common concretions and masses of calcium carbonate in most pedons. Reaction is slightly acid through moderately alkaline.

The C horizon consists of layers of variegated shaly clay, clay loam, and loam interbedded with shale. Colors are various shades of brown, gray, olive, and yellow. Reaction is mildly alkaline or moderately alkaline. There are few concretions of calcium carbonate and few black concretions in most pedons.

Dalco series

The Dalco series consists of moderately deep, moderately well drained, loamy soils on uplands. These soils formed in material that weathered from calcareous

shale and chalk under a prairie grass plant community. Slopes range from 1 to 4 percent.

Typical pedon of Dalco soils, in an area of Fairlie and Dalco soils, 1 to 4 percent slopes; from the intersection of Texas Highway 34 and Texas Highway 11 in Wolfe City, 3.0 miles southeast on Texas Highway 11, 1.8 miles south on county road, and 300 feet east in a cultivated field:

Ap—0 to 5 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine and medium subangular blocky structure; very hard, friable; common fine roots; few worm casts; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A1—5 to 14 inches; black (10YR 2/1) clay; moderate fine and medium subangular blocky structure; very hard, friable; few fine roots; few worm casts; few intersecting slickensides in lower part of horizon; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—14 to 31 inches; dark gray (10YR 4/1) clay; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; few intersecting slickensides; few fine black concretions; common concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cr—31 to 38 inches; light gray (2.5Y 7/2) and white (2.5Y 8/2) coarse platy chalk; streaks of olive yellow; massive below a depth of 38 inches; hardness is less than 3 on Mohs' scale.

The solum is 24 to 40 inches thick. The texture is silty clay loam, silty clay, or clay throughout. The soil is mildly alkaline or moderately alkaline and is typically calcareous. There are few to common concretions and soft masses of calcium carbonate, few black concretions, and few chert pebbles in most horizons. Chalk fragments range from none to common.

The A horizon is about 10 to 40 inches thick. It is black over very dark gray. There are few fine or medium mottles in shades of brown, yellow, or olive in some pedons.

The AC horizon is dark gray, gray, very dark grayish brown, dark grayish brown, grayish brown, or olive gray. There are few to many mottles in shades of brown, yellow, or olive, or the horizon is variegated in these colors.

The Cr horizon is light gray or white chalk; it has yellow streaks in some pedons. It is typically platy in the upper 8 inches and massive below, with a hardness of less than 3 on Mohs' scale.

Fairlie series

The Fairlie series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in material that weathered from calcareous shale and chalk under a prairie grass plant community. Slopes range from 1 to 4 percent.

Typical pedon of Fairlie soils, in an area of Fairlie and Dalco soils, 1 to 4 percent slopes; from the intersection of Texas Highway 34 and Texas Highway 11 in Wolfe City, 3.0 miles southeast on Texas Highway 11, 1.8 miles south on county road, 0.8 mile west on county road, 0.1 mile south along turnrow, and 40 feet east, in a cultivated field:

Ap—0 to 5 inches; very dark gray (10YR 3/1) silty clay loam; weak medium platy structure parting to weak fine and medium blocky; extremely hard, firm; few fine roots; few fine black concretions; weakly calcareous; mildly alkaline; clear smooth boundary.

A11—5 to 24 inches; black (5Y 2/1) silty clay loam; moderate fine and medium blocky structure; very hard, firm; few fine roots; few intersecting slickensides; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—24 to 35 inches; very dark gray (5Y 3/1) silty clay; few medium distinct olive (5Y 5/3) mottles; moderate fine and medium blocky structure; very hard, firm; few fine roots; common grooved intersecting slickensides; few fine black concretions; few concretions and soft masses of calcium carbonate; few fine and medium chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC—35 to 54 inches; dark gray (10YR 4/1) clay; few fine and medium distinct yellowish brown (10YR 5/8) and olive (5Y 5/6) mottles and few vertical streaks of black along old cracks; moderate fine blocky structure; very hard, firm; few fine roots; many intersecting slickensides that form wedge-shaped peds with long axes tilted about 30 degrees from horizontal; few fine black concretions; few concretions and soft masses of calcium carbonate; few medium chert pebbles; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—54 to 60 inches; white (N 8/0 and 2.5Y 8/2) chalk; streaks of olive yellow; medium platy structure in upper 2 inches, massive below; hardness is less than 3 on Mohs' scale.

The solum is 40 to 60 inches thick. Texture is silty clay loam, silty clay, or clay throughout. When the soil is dry, cracks 0.4 inch to 3 inches wide extend from the surface to a depth of more than 20 inches. The soil is mildly alkaline or moderately alkaline and is typically calcareous. There are few to common concretions and soft masses of calcium carbonate in most horizons and few fine black concretions and few fine, medium, or coarse chert fragments. Chalk fragments range from none to common.

The A horizon ranges from 20 to about 50 inches in thickness. It is black, very dark gray, or very dark grayish

brown. There are few fine or medium distinct mottles in shades of brown, yellow, or olive in some pedons.

The AC horizon is dark gray, gray, very dark grayish brown, dark grayish brown, grayish brown, or olive gray. There are few to many fine, medium, or coarse mottles in shades of brown, yellow, gray, or olive, or the horizon is prominently mottled in these colors and has no matrix color.

The C horizon is clay, shaly clay, or silty clay and commonly has thin strata of weathered chalk. Colors are mainly shades of gray, olive, and brown. The AC and C horizons are not diagnostic to the series and are absent in some pedons.

The Cr horizon is light gray or white chalk. It is typically platy in the upper 2 to 8 inches and massive below that. Its hardness is less than 3 on Mohs' scale.

Ferris series

The Ferris series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous shaly clay under a prairie grass plant community. Slopes range from 2 to 12 percent.

Typical pedon of Ferris clay, 5 to 12 percent slopes, eroded; from the intersection of Texas Highway 69 and Farm Road 1562 in Celeste, 4.3 miles west on Farm Road 1562, 2.8 miles north on county road, 0.4 mile west, 50 feet south, and 100 feet west, in a microdepression in a pasture:

Ap—0 to 6 inches; dark olive gray (5Y 3/2) clay; moderate fine and very fine subangular blocky structure; very hard, very firm; common fine roots; few pressure faces; few concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

AC1—6 to 30 inches; olive (5Y 5/3) clay; common medium faint olive (5Y 5/4) mottles and few dark olive gray streaks along old cracks; weak fine and medium subangular blocky structure; very hard, very firm; few fine roots; common intersecting slickensides; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC2—30 to 42 inches; olive (5Y 5/3) clay; common medium distinct light olive brown (2.5Y 5/6) and gray (10YR 6/1) mottles and few streaks of dark olive gray along old cracks; weak medium blocky structure; very hard, very firm; few very fine roots; common intersecting slickensides; common concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—42 to 76 inches; variegated gray (10YR 6/1), dark gray (10YR 4/1), yellowish brown (10YR 5/8), and light olive brown (2.5Y 5/4) shale and shaly clay; massive; extremely hard, very firm; few fine roots; few slickensides; few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to about 50 inches in thickness. It is typically calcareous, moderately alkaline clay or silty clay throughout. When the soil is dry, cracks 0.4 inch to 3 inches wide form to a depth of 20 inches or more. Cycles of microknolls and microdepressions are repeated each 4 to 16 feet.

The A horizon is dark olive gray, very dark grayish brown, dark grayish brown, olive, or olive brown. There are a few brown and yellow mottles in some pedons.

The AC horizon is olive, light olive brown, olive brown, grayish brown, or olive gray. In some places it has mottles in those colors and in other shades of yellow, gray, and brown. Gray colors are inherited from the parent material. Concretions and soft masses of calcium carbonate range from few to common.

Typically, the C horizon consists of layers of variegated gray, brown, and yellow shale and shaly clay. There are a few concretions of calcium carbonate in most pedons. Some pedons have a few gypsum crystals.

Gasil series

The Gasil series consists of deep, well drained, sandy soils on uplands. These soils formed in acid loamy sediment under a plant community of mixed hardwoods and native grasses. Slopes range from 8 to 12 percent.

Typical pedon of Gasil loamy fine sand, 8 to 12 percent slopes; 1.9 miles southwest on Farm Road 429 from its intersection with Farm Road 751 near West Tawakoni, 0.4 mile west on county line road, 0.9 mile north on Mountain View Club Road, and 75 feet southeast, in a wooded pasture:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand; moderate fine granular structure; slightly hard, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

A2—6 to 19 inches; brown (10YR 5/3) loamy fine sand; weak fine subangular blocky structure; slightly hard, very friable; common fine and few medium roots; common pores; few worm casts; neutral; abrupt smooth boundary.

B21t—19 to 34 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate fine and medium subangular blocky structure; hard, friable; few fine and medium roots; few pores; common clay films on surface of peds; very strongly acid; gradual wavy boundary.

B22t—34 to 60 inches; light olive brown (2.5Y 5/4) sandy clay loam; weak medium and coarse subangular blocky structure; hard, friable; few fine roots; few patchy clay films on surface of peds; very strongly acid; gradual wavy boundary.

B3—60 to 72 inches; light olive brown (2.5Y 5/4) sandy clay loam; common fine and medium distinct reddish yellow (7.5YR 6/8) and few fine distinct light gray mottles; weak coarse subangular blocky structure; hard, friable; few fine roots; few very fine black concretions; extremely acid.

The solum is more than 60 inches thick.

The A1 horizon is dark grayish brown, dark brown, or brown. The A2 horizon is grayish brown, brown, or pale brown. Texture is fine sandy loam or loamy fine sand. The A horizon is 8 to 20 inches thick. Reaction is slightly acid through mildly alkaline.

The B2t horizon is yellowish brown, strong brown, or light olive brown. In some pedons it has mottles in shades of brown, red, olive, and gray. Texture is sandy clay loam or clay loam. Reaction is extremely acid through slightly acid.

Gasil soils in this survey area have a B3 horizon that ranges to extremely acid. Consequently, they are considered taxadjuncts, but their use and behavior are not affected.

Heiden series

The Heiden series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous shaly clay under a prairie grass plant community. Slopes range from 2 to 8 percent.

Typical pedon of Heiden clay, 5 to 8 percent slopes; from the intersection of U.S. Highway 69 and Farm Road 1562 in Celeste, 3.1 miles west on Farm Road 1562, 0.65 mile north on county road, and 175 feet east, in a native grass meadow:

A11—0 to 5 inches; black (5Y 2/1) clay; moderate fine and very fine blocky structure; very hard, very firm; many fine and medium and few coarse roots; common pressure faces; calcareous; moderately alkaline; clear wavy boundary.

A12—5 to 18 inches; black (5Y 2/2) clay; moderate medium blocky structure parting to moderate very fine blocky; very hard, very firm; many fine and medium and few coarse roots; common worm casts; few slickensides; common pressure faces; few fine black concretions; calcareous; moderately alkaline; gradual wavy boundary.

AC1—18 to 30 inches; olive gray (5Y 4/2) clay; few medium distinct olive (5Y 5/4) mottles; moderate fine blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds with long axes tilted about 30 degrees from horizontal; few fine black concretions; few concretions of calcium carbonate; few fine chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC2—30 to 40 inches; olive (5Y 4/3) clay; few medium distinct olive (5Y 5/6) and common fine distinct olive gray mottles; moderate fine and medium blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds; few fine black concretions; common concretions and soft masses of calcium carbonate; few thin strata of gray shale; calcareous; moderately akaline; gradual wavy boundary.

C—40 to 62 inches; gray (5Y 6/1) shaly clay with variegated and mottled layers of olive brown (2.5Y 4/4) and yellowish brown (10YR 5/8); massive; extremely hard, very firm; few fine roots; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 60 inches thick. Intersecting slickensides begin at a depth of about 16 inches. When the soil is dry, cracks form that are 0.4 inch to 3 inches wide and 20 inches or more deep. Cycles of microknolls and microdepressions are repeated each 10 to 25 feet.

The A horizon is black, very dark gray, very dark grayish brown, dark grayish brown, olive gray, or dark olive gray. Reaction is mildly alkaline or moderately alkaline.

The color of the AC horizon is shades of olive, gray, or brown. It has few to many mottles in those colors as well as in shades of yellow. Typically it has few to common concretions and soft masses of calcium carbonate.

The C horizon consists of layers of variegated olive, gray, brown, and yellow shaly clay, clay, and shale. Calcium carbonate concretions and soft masses range from none to common.

Hopco series

The Hopco series consists of deep, somewhat poorly drained, loamy soils on flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Hopco silt loam, frequently flooded; from the intersection of Texas Highway 24 and Texas Highway 50 in Commerce, 2.0 miles south on Texas Highway 50, and 80 feet west, in a pasture:

A11—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and very fine subangular blocky structure; hard, friable; many fine and very fine roots; common pores; common worm casts; neutral; clear smooth boundary.

A12—7 to 32 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine subangular blocky structure; hard, friable; many fine and very fine roots; common pores; common worm casts; neutral; gradual smooth boundary.

A13—32 to 52 inches; very dark grayish brown (10YR 3/2) clay loam with a few fine faint yellowish brown mottles; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few fine masses of neutral salts; few concretions of calcium carbonate; mildly alkaline; gradual smooth boundary.

B2g—52 to 67 inches; dark grayish brown (10YR 4/2) clay loam; common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few fine black concretions; few

concretions of calcium carbonate; moderately alkaline.

The solum is 40 to more than 60 inches thick. Texture is silty clay loam, silt loam, or clay loam. Reaction is neutral through moderately alkaline throughout.

The A horizon is very dark gray, very dark grayish brown, dark brown, or very dark brown. In most pedons it has few to common mottles in shades of brown in the lower part.

The Bg horizon is not diagnostic to the series. Where present, it is very dark gray, very dark grayish brown, dark gray, dark grayish brown, or gray and has mottles in these colors as well as in various other shades of brown and gray.

In some pedons there is a C horizon that consists of variegated layers in shades of brown, gray, and yellow. In some pedons there are few concretions of calcium carbonate in the lower horizons.

Houston Black series

The Houston Black series consists of deep, moderately well drained, clayey soils on uplands. These soils formed in calcareous shaly clay under a prairie grass plant community. Slopes range from 1 to 3 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from the intersection of Texas Highway 66 and Farm Road 36 in Caddo Mills, 2.9 miles north on Farm Road 36, 0.9 mile east and 0.1 mile north on county road, and 55 feet west, in a microdepression in a cultivated field:

Ap—0 to 7 inches; black (10YR 2/1) clay; moderate fine and medium subangular blocky structure; very hard, very firm; many fine roots; common pressure faces; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A1—7 to 40 inches; black (10YR 2/1) clay; moderate fine and medium subangular blocky structure; very hard, very firm; few fine roots; few worm casts; many intersecting slickensides that form wedge-shaped peds with long axes tilted about 35 degrees from horizontal; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—40 to 56 inches; dark gray (10YR 4/1) clay; few fine and medium distinct light olive brown (2.5Y 5/4) mottles and few vertical streaks of black along cracks; weak fine and very fine subangular blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds; few fine black concretions; common concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC2—56 to 64 inches; dark gray (10YR 4/1) clay; common fine and medium distinct light olive brown (2.5Y 5/6) mottles and few vertical streaks of black along cracks; few medium light brownish gray (2.5Y 6/2) shale fragments; weak subangular blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds; few fine black concretions; common concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—64 to 80 inches; mottled light yellowish brown (2.5Y 6/4), olive yellow (2.5Y 6/6), light brownish gray (2.5Y 6/2), and dark gray (10YR 4/1) shaly clay; massive; extremely hard, very firm; few fine roots; common intersecting slickensides; few concretions and soft masses of calcium carbonate; moderately alkaline.

The thickness of the combined A and AC horizons ranges from 60 to more than 100 inches. Intersecting slickensides begin at a depth of about 16 inches. When the soil is dry, cracks form that are 0.4 inch to 3 inches wide and 20 inches or more deep. Cycles of microknolls and microdepressions are repeated each 10 to 24 feet.

The A horizon is black, very dark gray, or dark gray. It is moderately alkaline except in some pedons in microdepressions where it is mildly alkaline.

The AC horizon ranges from dark gray to grayish brown in the upper part and from dark gray to yellow in the lower part. Typically it has few to many mottles in shades of brown, gray, olive, and yellow.

The C horizon is shaly clay in shades of gray, olive, brown, and yellow.

In most pedons there are few to common concretions and soft masses of calcium carbonate throughout, as well as few black concretions and chert pebbles.

Kaufman series

The Kaufman series consists of deep, somewhat poorly drained, clayey soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Kaufman clay, frequently flooded; from the intersection of Farm Road 2101 and Texas Highway 34 about 12 miles south of Greenville, 0.6 mile south on Texas Highway 34, 0.1 mile east along main channel of Caddo Creek, and 250 feet south of channel, in a wooded pasture:

A11—0 to 6 inches; black (10YR 2/1) clay; weak very fine subangular blocky structure; extremely hard, very firm; few fine and medium roots; few worm casts; mildly alkaline; gradual wavy boundary.

A12—6 to 34 inches; black (10YR 2/1) clay; weak fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few slickensides which increase in size and number with depth; few fine black concretions; moderately alkaline; gradual wavy boundary.

A13—34 to 53 inches; black (10YR 2/1) clay; common fine distinct dark yellowish brown mottles that encircle black concretions; weak medium blocky structure; extremely hard, very firm; few fine roots; common grooved intersecting slickensides; moderately alkaline; gradual wavy boundary.

ACg—53 to 80 inches; very dark gray (10YR 3/1) clay; weak coarse blocky structure; extremely hard, very firm; few very fine roots; common grooved intersecting slickensides; few fine black concretions; slightly acid.

The solum ranges from 60 to more than 100 inches in thickness. Intersecting slickensides begin at a depth of about 16 inches. When the soil is dry, cracks form that are 0.4 inch to 3 inches wide and extend to a depth of more than 20 inches. Reaction is slightly acid through moderately alkaline and is typically noncalcareous. In some pedons there are few concretions of calcium carbonate below a depth of 24 inches.

The A horizon is black or very dark gray. In some pedons it has few to common mottles in shades of brown in the lower part.

The ACg horizon is very dark gray or dark gray. In some pedons it has few to common mottles in shades of gray and brown. In some pedons the soil material below a depth of 40 inches is dark grayish brown or grayish brown.

Lamar series

The Lamar series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in calcareous loamy sediments under a prairie grass plant community. Slopes range from 5 to 12 percent.

Typical pedon of Lamar loam, 5 to 12 percent slopes; 4.0 miles south on Texas Highway 34 from its intersection with Farm Road 512 in Wolfe City, 0.5 mile west on county road to gate, and 150 feet northwest, in a pasture:

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) loam; moderate fine subangular blocky structure; hard, friable; common fine and medium roots; few pores; few worm casts; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 22 inches; light olive brown (2.5Y 5/4) loam; few fine and medium faint light olive brown (2.5Y 5/6) mottles and few olive brown coatings on surface of some peds; moderate fine and very fine subangular blocky structure; hard, friable; common fine and medium roots; few pores; few worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B3—22 to 36 inches; light olive brown (2.5Y 5/4) loam; common coarse faint light olive brown (2.5Y 5/6) and olive brown (2.5Y 4/4) mottles; moderate fine and medium subangular blocky structure with thin massive strata; hard, friable; few fine roots; few pores; few concretions and soft masses of calcium carbonate; few thin silt strata in lower part; calcareous; moderately alkaline; gradual smooth boundary.

C—36 to 60 inches; variegated layers of light olive brown (2.5Y 5/4, 5/6), light gray (10YR 6/1, 7/1), and yellowish brown (10YR 5/6) loam, clay loam, and shaly clay; massive; hard, firm; few fine roots; common concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 25 to 50 inches thick. Reaction is neutral through moderately alkaline and typically is calcareous.

The A horizon is dark brown, grayish brown, dark grayish brown, or very dark grayish brown. Texture is loam or clay loam.

The B horizon is dark grayish brown, olive brown, or light olive brown. Most pedons have few to common mottles in shades of gray, yellow, and brown. Gray colors are related to the parent material. Texture is loam, clay loam, or silty clay loam. Concretions and soft masses of calcium carbonate make up 5 to 30 percent of some horizons.

The C horizon is variegated layers of loam, clay loam, and shaly clay in shades of brown, yellow, and gray. There are few to common concretions and soft masses of calcium carbonate.

Leson series

The Leson series consists of deep, moderately well drained, clayey soils on uplands. These soils formed in alkaline shaly clay under a prairie grass plant community. Slopes range from 1 to 5 percent.

Typical pedon of Leson clay, 1 to 3 percent slopes; from the intersection of Texas Highway 276 and Texas Highway 34 in Quinlan, 0.5 mile north on Texas Highway 34, 0.6 mile east on county road, and 250 feet north, in an idle field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm; many fine and few coarse roots; few fine black concretions; few concretions of calcium carbonate; mildly alkaline; clear smooth boundary.

A1—6 to 28 inches; very dark gray (10YR 3/1) clay; moderate medium and coarse blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds with long axes tilted about 35 degrees from horizontal; few fine black concretions; few concretions of calcium carbonate; mildly alkaline; gradual wavy boundary.

AC—28 to 58 inches; dark grayish brown (2.5Y 4/2) clay; common fine distinct light olive brown mottles and few very dark gray vertical streaks; moderate

coarse blocky structure; very hard, very firm; few fine roots; many intersecting slickensides that form wedge-shaped peds; few fine black concretions; common concretions of calcium carbonate; few medium chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

C—58 to 72 inches; mottled grayish brown (2.5Y 5/2), light gray (10YR 6/1), and light olive brown (2.5Y 5/6) shaly clay; vertical streaks of yellowish brown and very dark gray; massive; extremely hard, very firm; few fine roots; few concretions of calcium carbonate in upper part; few gypsum crystals; calcareous; moderately alkaline.

The solum is 36 to 80 inches thick. When the soil is dry, there are cracks 1 to 3 inches wide throughout the solum.

The A horizon is slightly acid through mildly alkaline. It is black, very dark gray, or dark gray. It has a few mottles in shades of brown or olive in the lower part in some pedons. In virgin areas there is gilgai microrelief. The distance between microknolls and microdepressions ranges from 4 to about 16 feet. The A horizon is 6 to 20 inches thick on microknolls and 20 to 60 inches thick in microdepressions. In some pedons there are few concretions of calcium carbonate. Intersecting slickensides are common below a depth of 15 inches.

The AC horizon is neutral to moderately alkaline and is calcareous in most pedons. It is grayish brown, dark grayish brown, very dark grayish brown, olive, olive gray, or pale olive. It has few to many mottles in shades of gray, brown, and yellow. Typically, there are few to common concretions and soft masses of calcium carbonate.

The C horizon consists of variegated layers of clay, shale, and shaly clay in shades of brown, olive, and gray. It is mildly alkaline or moderately alkaline and is calcareous in most pedons. It has few to common concretions and soft masses of calcium carbonate.

Lufkin series

The Lufkin series consists of deep, somewhat poorly drained, loamy soils on old terraces. These soils formed in acid clayey sediment under a mixed hardwood and native grass plant community. Slopes range from 0 to 1 percent.

Typical pedon of Lufkin loam, in an area of Lufkin-Rader complex; from the intersection of Texas Highway 34 and Farm Road 2101 about 12 miles south of Greenville, 6.4 miles east and north on Farm Road 2101, 1.6 miles east on Farm Road 2947, 0.3 mile east on old paved road, 0.5 mile south on private road, and 300 feet east, in an intermound in a pasture:

A1—0 to 4 inches; grayish brown (10YR 5/2) loam; weak fine and medium subangular blocky structure; very hard, friable; many fine and very fine and few coarse roots; slightly acid; clear smooth boundary.

A2—4 to 8 inches; light brownish gray (10YR 6/2) loam; weak very fine subangular blocky structure; hard, very friable; common fine and few coarse roots; medium acid; abrupt wavy boundary.

B21tg—8 to 25 inches; grayish brown (10YR 5/2) clay; common fine distinct dark brown mottles; moderate medium and coarse blocky structure; extremely hard, very firm; few fine and coarse roots; many patchy clay films on surface of peds; very strongly acid; gradual wavy boundary.

B22tg—25 to 50 inches; dark grayish brown (10YR 4/2) clay; dark gray coatings on surface of peds; moderate coarse blocky structure; extremely hard, very firm; few fine and coarse roots; few intersecting slickensides; few fine masses of neutral salts; slightly acid; gradual wavy boundary.

B23tg—50 to 74 inches; light brownish gray (2.5Y 6/2) clay; common fine distinct brown and few fine distinct yellow mottles; weak medium and coarse blocky structure; extremely hard, very firm; few fine and medium roots; few slickensides; common clay films on surface of peds; few fine black concretions; mildly alkaline; gradual wavy boundary.

B3g—74 to 80 inches; light olive gray (5Y 6/2) clay; common fine distinct yellowish brown and few fine distinct dark yellowish brown mottles; weak coarse prismatic structure parting to weak medium and coarse blocky; extremely hard, very firm; few fine roots; few fine black concretions; few fine masses of neutral salts; mildly alkaline.

The solum is 40 to more than 60 inches thick.

The A1 horizon is dark grayish brown, grayish brown, dark gray, or very dark grayish brown. The A2 horizon is light brownish gray, light gray, gray, or white. Mottles in shades of brown range from none to common in the A horizon. Texture is loam or silt loam. The A horizon is typically less than 10 inches thick. Reaction is strongly acid through slightly acid.

The B2tg horizon is dark grayish brown, grayish brown, dark gray, gray, or light brownish gray. Mottles in shades of brown and gray range from none to common. Texture is clay but ranges to clay loam below a depth of 40 inches. Reaction increases with depth; it is very strongly acid through mildly alkaline.

The B3g horizon is clay in shades of gray with mottles in shades of brown, gray, and yellow. In some pedons there are layers of sandy clay loam, clay loam, or loam. Reaction is slightly acid through moderately alkaline.

Nahatche series

The Nahatche series consists of deep, somewhat poorly drained, loamy soils on flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Nahatche loam, frequently flooded; 5.2 miles north on Farm Road 36 from its intersection

with Farm Road 35 about 2 miles west of Quinlan, 60 feet west, in a pasture:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) loam, common fine distinct strong brown mottles; weak fine and medium subangular blocky structure; hard, friable; common fine and very fine roots; medium acid; clear smooth boundary.
A12—4 to 9 inches; brown (10YR 5/3) loam; common fine faint dark yellowish brown and few fine distinct strong brown mottles; weak medium subangular blocky structure; hard, friable; common fine roots; few pores; few fine black concretions; medium acid; clear smooth boundary.
C1g—9 to 27 inches; dark grayish brown (10YR 4/2) clay loam, common fine faint dark yellowish brown and few medium faint dark gray (10YR 4/1) mottles; weak fine and very fine subangular blocky structure; very hard, firm; few fine roots; few pores; few fine black concretions; slightly acid; gradual smooth boundary.
C2g—27 to 37 inches; mottled dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2), and dark yellowish brown (10YR 4/6) clay loam; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine black concretions; few thin strata of loam; slightly acid; gradual smooth boundary.
C3g—37 to 60 inches; grayish brown (10YR 5/2) sandy clay loam; common fine and medium brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; hard, friable; few fine roots; few thin strata of loam; neutral.

Reaction is medium acid through mildly alkaline, but in some pedons it is strongly acid in the subsurface layers. Texture is loam, clay loam, or sandy clay loam, and in some pedons there are thin strata of coarser textured material.

The A horizon is dark grayish brown, brown, very dark grayish brown, or grayish brown. In some pedons it has few to common mottles in shades of gray or brown.

The C1g horizon is dark grayish brown or grayish brown. In addition to these colors, the lower Cg horizons are dark gray, gray, or light brownish gray or are mottled in those colors. Mottles throughout the Cg horizons are yellowish brown, dark yellowish brown, light gray, dark gray, strong brown, grayish brown, very dark grayish brown, brown, or brownish yellow. In some pedons there is a buried horizon below a depth of 40 inches.

Rader series

The Rader series consists of deep, moderately well drained, loamy soils on old terraces and uplands. These soils formed in acid loamy sediment under a plant community of mixed hardwoods and native grasses. Slopes range from 0 to 3 percent.

Typical pedon of Rader fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 34 and Farm Road 35 in Quinlan, 3.8 miles west on Farm Road 35, 0.15 mile north on county road at Stringtown Community Center, and 125 feet west, in a pasture:

A1—0 to 8 inches; brown (10YR 4/3) fine sandy loam; weak fine granular and subangular blocky structure; slightly hard, very friable; many fine and very fine roots; few fine pebbles; medium acid; gradual smooth boundary.
A2—8 to 22 inches; brown (10YR 5/3) fine sandy loam; weak fine and medium subangular blocky structure; slightly hard, very friable; many fine roots; few fine pebbles; slightly acid; clear wavy boundary.
Bt&A'2—22 to 34 inches; yellowish brown (10YR 5/4) sandy clay loam; common fine and medium faint yellowish brown (10YR 5/6) and few fine distinct red and gray mottles; weak medium subangular blocky structure; very hard, friable; few fine roots; few fine pebbles; A'2 soil material is grayish brown (10YR 5/2) fine sandy loam and makes up about 25 percent of the horizon as coatings on surface of peds and in small pockets and streaks of uncoated sand; slightly acid; abrupt wavy boundary.
B21t—34 to 53 inches; mottled gray (10YR 5/1), yellowish brown (10YR 5/6), and dark red (2.5YR 3/6) sandy clay; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots; few slickensides that are 1 to 3 inches wide; common clay films on surface of peds; few fine black concretions; few streaks of uncoated sand; strongly acid; gradual wavy boundary.
B22t—53 to 70 inches; gray (10YR 5/1) sandy clay, many medium distinct yellowish brown (10YR 5/6) and common coarse distinct red (2.5YR 4/6) mottles; weak medium blocky structure; extremely hard, very firm; few fine roots; common clay films on surface of peds; few fine black concretions; strongly acid; gradual wavy boundary.
B3—70 to 80 inches; yellowish brown (10YR 5/6) sandy clay loam, few medium distinct gray (10YR 5/1) and few fine distinct red mottles; weak medium blocky structure; very hard, firm; few fine roots; few patchy clay films on surface of peds; few fine black concretions; strongly acid.

The solum is 60 to more than 100 inches thick.

The A1 or Ap horizon is brown, dark grayish brown, or grayish brown. The A2 horizon is brown, grayish brown, very pale brown, light gray, white, or light brownish gray. Texture is loam or fine sandy loam. Reaction is very strongly acid through medium acid.

The Bt&A'2 horizon is strongly acid through slightly acid. The Bt soil material is yellowish brown, brownish yellow, and other shades of brown in hues of 7.5YR and 10YR. There are few to common mottles in shades of

red, gray, and brown. Texture is loam or sandy clay loam. The A'2 soil material is grayish brown, very pale brown, light gray, white, or light brownish gray. Texture is fine sandy loam or loam. A'2 material makes up 10 to 30 percent of the horizon as streaks, pockets, and coatings on the surface of peds.

The B2t horizon is red, dark red, yellowish red, strong brown, yellowish brown, or gray and is typically mottled in these colors. Streaks and coatings of A'2 material are in the upper part of the B2t horizon in some pedons. Texture is clay, sandy clay, or clay loam; the clay content is 27 to 50 percent. Reaction is very strongly acid through slightly acid.

The B3 horizon and the C horizon where present, are sandy clay loam, clay loam, or sandy clay in shades of brown, yellow, and gray. They typically are mottled in these colors. Reaction is strongly acid through mildly alkaline.

Stephen series

The Stephen series consists of shallow, clayey soils on uplands. These soils formed in material that weathered from calcareous shale and chalk under a prairie grass plant community. Slopes range from 2 to 5 percent.

Typical pedon of Stephen silty clay, 2 to 5 percent slopes; 4.0 miles northwest on U.S. Highway 69 from its intersection with Farm Road 1562 in Celeste, 1.0 mile west on county road, 0.8 mile north on county road, 660 feet west on county road, and 25 feet south, in a pasture:

A11—0 to 6 inches; very dark grayish brown (2.5Y 3/2) silty clay; moderate fine and very fine subangular blocky structure; hard, friable; common fine roots; few pores; common worm casts; few fine black concretions; common chalk fragments; calcareous; moderately alkaline; clear wavy boundary.

A12—6 to 12 inches; dark grayish brown (2.5Y 4/2) silty clay; common streaks of pale olive (5Y 6/4); moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few pores; common worm casts; few fine black concretions; few chalk fragments; calcareous; moderately alkaline; clear wavy boundary.

C&A—12 to 17 inches; about 55 percent, by volume, partly weathered chalk and platy chalk fragments interbedded with pale olive (5Y 6/4) silty clay; few fine roots between chalk fragments; few pores and worm casts; calcareous; moderately alkaline; clear irregular boundary.

Cr—17 to 21 inches; white (5Y 8/1) platy chalk; streaks of olive yellow and thin strata of olive gray (5Y 5/2) soil material between some chalk plates; massive below a depth of 21 inches; hardness is less than 3 on Mohs' scale.

The solum is 7 to about 20 inches thick over platy chalk. Texture is silty clay, clay loam, or clay. Mollic colors are dominant throughout the soil.

The A horizon is very dark grayish brown, dark grayish brown, very dark gray, or olive gray. Some pedons have pale olive streaks in the lower part. Chalk fragments make up 2 to 35 percent of the volume.

The Cr horizon is platy chalk and silty clay that becomes massive with depth. When moist, the chalk can be cut with a spade; its hardness is less than 3 on Mohs' scale.

Tinn series

The Tinn series consists of deep, somewhat poorly drained, clayey soils on flood plains. These soils formed in calcareous clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Loop 315 and Texas Highway 66 in Greenville, 3.3 miles southwest on Texas Highway 66, and 0.3 mile north, in a pasture:

A11—0 to 8 inches; black (10YR 2/1) clay; moderate fine and very fine blocky structure; extremely hard, very firm; common fine and very fine roots; few worm casts; common pressure faces; calcareous; moderately alkaline; gradual wavy boundary.

A12—8 to 26 inches; black (10YR 2/1) clay; weak medium subangular blocky structure; extremely hard, very firm; few fine and very fine roots; few slickensides; calcareous; moderately alkaline; gradual wavy boundary.

A13—26 to 39 inches; black (10YR 2/1) clay; few medium faint very dark gray (10YR 3/1) mottles; weak medium subangular blocky structure; extremely hard, very firm; few fine roots; common grooved slickensides; few threads and films of calcium carbonate; few thin strata of silt; calcareous; moderately alkaline; gradual wavy boundary.

A14—39 to 76 inches; black (10YR 2/1) clay; weak medium subangular blocky structure; extremely hard, very firm; few very fine roots; many grooved slickensides; few fine black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 100 inches thick. There are common to many slickensides below a depth of 24 inches. When the soil is dry, cracks form that are 0.4 inch to 3 inches wide and extend to a depth of more than 20 inches. The soil is mildly alkaline or moderately alkaline. Typically, it is calcareous throughout; however, in some pedons there are noncalcareous layers in the lower part.

The A horizon is very dark gray or black. In some pedons it has a few mottles in shades of gray, yellow, and brown.

In some pedons the C horizon is dark olive gray, very dark gray, or dark gray. In most pedons it has few to common mottles in shades of gray and brown.

Wilson series

The Wilson series consists of deep, somewhat poorly drained, loamy soils on old terraces. These soils formed in alkaline clayey sediment under a prairie grass plant community. Slopes range from 0 to 1 percent.

Typical pedon of Wilson silt loam, 0 to 1 percent slopes; 1.1 miles north on Texas Highway 34 from its intersection with Farm Road 2101 about 12 miles south of Greenville, 0.2 mile east on private road, and 200 feet north, in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and very fine subangular blocky structure; very hard, friable; few fine roots; medium acid; clear smooth boundary.

B21tg—6 to 15 inches; very dark gray (10YR 3/1) clay; weak coarse blocky structure; extremely hard, very firm; few fine roots; few pressure faces; few patchy clay films on surface of peds; few fine black concretions; slightly acid; gradual wavy boundary.

B22tg—15 to 34 inches; very dark gray (10YR 3/1) clay; few fine distinct dark yellowish brown mottles; weak coarse blocky structure parting to moderate fine subangular blocky; extremely hard, very firm; few fine roots; few intersecting slickensides; clay films on surface of most peds; few fine black concretions; slightly acid; gradual wavy boundary.

B23tg—34 to 47 inches; black (N 2/0) clay; weak coarse blocky structure parting to moderate fine subangular blocky; extremely hard, very firm; few fine roots; common intersecting slickensides; common clay films on surface of peds; few fine black concretions; neutral; clear wavy boundary.

B24tg—47 to 64 inches; dark grayish brown (10YR 4/2) clay; very dark gray coatings on surface of peds; weak fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few intersecting slickensides; few fine black concretions; neutral; gradual wavy boundary.

B3g—64 to 80 inches; light gray (10YR 6/1) silty clay, few coarse distinct light olive brown (2.5Y 5/4) mottles; weak medium and coarse subangular blocky structure; extremely hard, very firm; few fine roots; few slickensides; few fine black concretions; moderately alkaline.

The solum is more than 60 inches thick. Most horizons contain a few black concretions. In some pedons the lower B2tg horizons and the B3g horizon have a few concretions of calcium carbonate.

The A or Ap horizon is dark gray, very dark gray, dark grayish brown, or very dark grayish brown. Texture is silt loam, silty clay loam, or clay loam. This horizon, on the average, is less than 10 inches thick, but it is as much as 15 inches thick in some subsoil troughs. It is medium acid or slightly acid.

The B2tg horizon is very dark gray, dark gray, or black in the upper part and dark grayish brown, grayish brown, gray, or light gray in the lower part. In some pedons it has few to common mottles in shades of brown and gray. Texture is clay, silty clay, or silty clay loam. Reaction is medium acid to moderately alkaline.

The B3g horizon is clay, silty clay loam, or silty clay in shades of gray and grayish brown. In some pedons it has mottles in shades of brown, yellow, or olive. It is neutral through moderately alkaline.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil horizon differentiation are described.

factors of soil formation

The characteristics of a soil are determined by five main factors: the physical and chemical composition of the parent material; the climate under which the parent material has existed since accumulation; the plant and animal life on and in the soil; relief, or lay of the land; and the length of time that climate, organisms, and relief have acted on the parent material. All of these factors influence the present characteristics of every soil, but the significance of each factor varies from place to place. In one area one factor may dominate soil formation, and in another area a different factor may be more important.

The interrelationship among these five factors is complex, and the effect of any single factor cannot be completely isolated and evaluated. It is convenient, however, to discuss each factor separately, and to indicate the probable effects of each.

parent material

Parent material is the unconsolidated mass from which a soil develops. It determines the mineral and chemical composition of the soil. In Hunt County, the parent material consists of sediments of Upper Cretaceous, Eocene, and Recent age.

The soils that formed in Upper Cretaceous formations cover most of the county. These soils are clayey throughout or have clay-enriched horizons. Leson and Houston Black soils formed in thick beds of calcareous clayey materials, and Crockett and Wilson soils formed in loamy and shaly sediments. Dalco, Fairlie, and Stephen soils formed in calcareous chalk.

Formations of Eocene age are the parent materials of the soils in the southern and eastern parts of the county. These are interbedded sandy and clayey sediments. Axtell, Lufkin, and Rader soils formed in the sandy materials, and Crockett and Wilson soils formed in the clayey materials.

Alluvium deposited in the flood plains of streams throughout the county is of Recent age. The nature of the alluvial sediments is determined by the surrounding upland soils. Kaufman and Tinn soils formed in clayey alluvium, and Hopco and Nahatche soils formed in loamy alluvium.

climate

The climate of Hunt County is warm and humid; summers are hot. The climate is fairly uniform throughout the county, although its effect on soil formation has been modified locally by relief and runoff. The high temperatures and adequate rainfall favor plant growth as well as chemical and microbial activity. This has resulted in the formation of many deep soils in the county.

plant and animal life

Plants, animals, and micro-organisms are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are brought about by living organisms.

In Hunt County, vegetation, mainly grasses, has affected soil development more than other living organism. Soils that developed under grasses tend to have a higher content of organic matter than soils that formed under trees.

relief

Relief, or topography, influences soil formation through its effect on drainage, erosion, and plant cover.

Nearly level soils, for example, Lufkin and Wilson soils, receive excess water and develop gleyed characteristics. Axtell and Crockett soils, which are gently sloping, are moderately well drained and exhibit distinct horizonation.

Plant cover is thinner in many of the more sloping areas. This increases the rate of erosion, preventing the sloping soils from becoming as deep as the more gently sloping soils. Ferris and Heiden soils, for example, formed in parent material similar to that of Houston Black soils but did not develop as deep soils because of their stronger slopes.

time

The length of time that climate, relief, and organisms have acted on the parent material determines, to a large degree, the characteristics of the soil. The degree of horizon development often reflects the length of time that the parent material has been in place. Young soils show little horizon development, and old soils have well-expressed horizons. Kaufman and Tinn soils are young

soils. They retain most of the characteristics of their clayey parent material. Older soils, for example, Axtell, Crockett, and Rader soils, have distinct A and Bt horizons that bear little resemblance to the original parent material.

processes of soil horizon differentiation

Several processes were involved in the formation of horizons in the soils of Hunt County: accumulation of organic matter, leaching of carbonates and bases, and formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon development.

Accumulation of organic matter in the upper part of the profile helps to form an A1 horizon. Clayey soils that shrink and swell with changes in moisture, for example, Houston Black and Leson soils, readily incorporate organic matter and form a thick, dark A1 horizon. Those soils generally have a higher content of organic matter than the loamy soils.

Rainfall in the survey area has been sufficient to cause leaching of carbonates and bases in most of the soils. Soils that developed in highly calcareous, clayey parent material, for example, Fairlie, Heiden, and Houston Black soils are the exception. Leaching leaves the soil more acid in reaction. In some soils, such as Lamar soils, distinct layers of accumulated carbonates have formed in the lower part of the profile as a result of incomplete leaching.

In most of the loamy soils of the county, the downward translocation of clay minerals has contributed to horizon development. Axtell, Crockett, Lufkin, Rader, and Wilson soils have a Bt horizon that has appreciably more silicate clay than the overlying A horizon. These soils were probably leached of carbonates before the downward movement of clay began.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface,

have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential, soil. The expected suitability of a soil for specific uses.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The

principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Greenville, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	53.1	31.2	42.2	79	9	29	2.17	1.11	3.04	4	1.1
February---	57.3	34.6	45.9	81	14	52	2.70	1.17	3.93	5	.5
March------	64.6	41.5	53.1	86	21	194	3.10	1.36	4.50	6	.2
April------	74.2	52.2	63.2	90	30	396	5.02	2.18	7.33	6	.0
May--------	81.6	60.6	71.1	94	43	654	5.21	2.75	7.22	7	.0
June-------	89.7	68.2	79.0	99	54	870	3.39	1.05	5.25	5	.0
July-------	94.2	71.7	83.0	103	61	1,023	2.94	1.20	4.34	5	.0
August-----	94.7	70.6	82.7	105	59	1,014	1.95	.50	3.12	4	.0
September--	87.7	64.3	76.0	101	47	780	4.61	1.45	7.11	5	.0
October----	78.3	53.1	65.7	93	33	487	3.97	.74	6.45	4	.0
November---	65.0	41.5	53.2	84	22	150	3.17	1.37	4.62	5	.0
December---	56.0	33.9	45.0	78	13	39	2.81	1.30	4.02	5	.4
Year-----	74.7	52.0	63.3	106	8	5,688	41.04	32.29	49.27	61	2.2

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Greenville, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than-----	March 20	March 31	April 9
2 years in 10 later than-----	March 12	March 25	April 3
5 years in 10 later than-----	February 24	March 12	March 24
First freezing temperature in fall:			
1 year in 10 earlier than---	November 15	November 1	October 29
2 years in 10 earlier than---	November 24	November 8	November 3
5 years in 10 earlier than---	December 10	November 22	November 12

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-75 at Greenville, Texas]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	261	222	210
8 years in 10	270	233	218
5 years in 10	289	254	233
2 years in 10	308	275	247
1 year in 10	318	286	255

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent	Cultivated crops	Pasture	Urban uses	Recreation areas
1. Leson-Houston Black	30	High	High	Low: shrink-swell, percs slowly, too clayey.	Low: too clayey, percs slowly.
2. Ferris-Heiden	6	Low: water erosion, slope.	Low: water erosion, slope.	Low: shrink-swell, too clayey, percs slowly, slope.	Low: too clayey, percs slowly, slope.
3. Fairlie-Dalco	1	High	High	Low: percs slowly, too clayey, depth to rock.	Low: too clayey, percs slowly.
4. Crockett	22	Medium: water erosion.	Medium: water erosion.	Medium: shrink-swell, percs slowly.	Medium: percs slowly.
5. Axtell	10	Low: water erosion, slope.	Medium: water erosion.	Medium: shrink-swell, percs slowly.	Medium: percs slowly.
6. Wilson	9	Medium: wetness.	Medium: wetness.	Low: wetness, shrink-swell.	Low: wetness, percs slowly.
7. Lufkin-Rader	3	Medium: wetness.	Medium: wetness.	Low: wetness, shrink-swell.	Low: wetness, percs slowly.
8. Rader	2	Medium: wetness.	High: wetness.	Medium: percs slowly, wetness.	Medium: percs slowly, wetness.
9. Lamar	1	Low: water erosion, slope.	Low: water erosion, slope.	Medium: slope.	Medium: slope.
10. Kaufman-Tinn	11	Low: flooding.	High: flooding.	Low: flooding, percs slowly, shrink-swell.	Low: flooding, wetness, too clayey.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Axtell loam, 2 to 5 percent slopes	29,200	5.0
2	Axtell loam, 5 to 12 percent slopes	10,250	1.8
3	Bazette clay loam, 5 to 12 percent slopes	3,080	0.5
4	Branyon clay, 0 to 1 percent slopes	1,480	0.3
5	Burleson clay, 0 to 1 percent slopes	9,050	1.6
6	Crockett loam, 1 to 3 percent slopes	89,000	15.3
7	Crockett loam, 2 to 5 percent slopes, eroded	36,450	6.3
8	Crockett-Urban land complex, 1 to 3 percent slopes	3,150	0.5
9	Fairlie and Dalco soils, 1 to 4 percent slopes	5,250	0.9
10	Ferris clay, 5 to 12 percent slopes, eroded	15,450	2.6
11	Ferris-Heiden complex, 2 to 5 percent slopes, eroded	25,800	4.4
12	Gasil loamy fine sand, 8 to 12 percent slopes	270	*
13	Heiden clay, 2 to 5 percent slopes	10,300	1.8
14	Heiden clay, 5 to 8 percent slopes	1,850	0.3
15	Heiden-Urban land complex, 3 to 6 percent slopes	380	0.1
16	Hopco silt loam, frequently flooded	14,800	2.5
17	Houston Black clay, 1 to 3 percent slopes	53,900	9.2
18	Kaufman clay, occasionally flooded	2,470	0.4
19	Kaufman clay, frequently flooded	44,400	7.6
20	Lamar loam, 5 to 12 percent slopes	2,590	0.4
21	Leson clay, 1 to 3 percent slopes	66,750	11.5
22	Leson clay, 3 to 5 percent slopes	1,850	0.3
23	Leson-Urban land complex, 1 to 3 percent slopes	2,470	0.4
24	Lufkin-Rader complex	24,400	4.2
25	Nahatche loam, frequently flooded	11,300	1.9
26	Pits	183	*
27	Rader fine sandy loam, 1 to 3 percent slopes	6,600	1.1
28	Stephen silty clay, 2 to 5 percent slopes	920	0.2
29	Tinn clay, occasionally flooded	2,750	0.5
30	Tinn clay, frequently flooded	16,050	2.8
31	Wilson silt loam, 0 to 1 percent slopes	63,400	10.9
32	Wilson-Urban land complex, 0 to 1 percent slopes	303	0.1
	Water	26,944	4.6
	Total	583,040	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint	Grain sorghum	Corn	Improved bermudagrass
	Lb	Bu	Bu	AUM*
1-------------------------- Axtell	200	35	25	6.0
2-------------------------- Axtell	---	---	---	5.0
3-------------------------- Bazette	---	---	---	5.0
4-------------------------- Branyon	450	90	50	8.0
5-------------------------- Burleson	450	85	50	8.0
6-------------------------- Crockett	350	55	40	7.0
7-------------------------- Crockett	200	45	30	5.5
8-------------------------- Crockett-Urban land	---	---	---	---
9-------------------------- Fairlie and Dalco	430	80	50	8.0
10------------------------- Ferris	---	---	---	4.0
11------------------------- Ferris-Heiden	280	40	35	5.5
12------------------------- Gasil	---	---	---	4.5
13------------------------- Heiden	350	55	50	6.0
14------------------------- Heiden	---	35	---	4.0
15------------------------- Heiden-Urban land	---	---	---	---
16------------------------- Hopco	---	---	---	10.0
17------------------------- Houston Black	550	85	55	9.5
18------------------------- Kaufman	500	100	65	8.5
19------------------------- Kaufman	---	---	---	8.5
20------------------------- Lamar	---	---	---	4.0
21------------------------- Leson	450	80	45	8.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map smybol and soil name	Cotton lint	Grain sorghum	Corn	Improved bermudagrass
	Lb	Bu	Bu	AUM*
22 Leson	300	55	35	6.0
23 Leson-Urban land	---	---	---	---
24 Lufkin-Rader	---	45	40	6.0
25 Nahatche	---	---	---	8.0
26 Pits	---	---	---	---
27 Rader	---	70	55	8.0
28 Stephen	150	45	---	3.5
29 Tinn	500	100	60	8.0
30 Tinn	---	---	---	8.0
31 Wilson	350	55	45	6.0
32 Wilson-Urban land	---	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	143,131	127,381	15,750	---	---
III	206,363	111,782	78,465	16,116	---
IV	85,706	85,706	---	---	---
V	86,550	---	86,550	---	---
VI	31,640	31,640	---	---	---
VII	---	---	---	---	---
VIII	---	---	---	---	---

TABLE 8.--NATIVE GRAZING LAND

[Only the soils that support native grazing land vegetation are listed]

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
1, 2: Axtell	Favorable	5,000	Little bluestem	40
	Normal	3,500	Post oak	15
	Unfavorable	2,500	Indiangrass	10
			Beaked panicum	5
			Purpletop	5
			Florida paspalum	5
			Tall dropseed	5
			Blackjack oak	5
3: Bazette	Favorable	5,500	Little bluestem	35
	Normal	4,500	Indiangrass	10
	Unfavorable	2,000	Big bluestem	10
			Switchgrass	10
			Sideoats grama	10
			Panicum	5
			Post oak	5
			Blackjack oak	5
4: Branyon	Favorable	7,000	Little bluestem	50
	Normal	5,500	Indiangrass	13
	Unfavorable	3,500	Big bluestem	12
5: Burleson	Favorable	7,000	Little bluestem	40
	Normal	5,500	Indiangrass	15
	Unfavorable	4,000	Big bluestem	15
			Sideoats grama	5
			Texas needlegrass	5
			Silver bluestem	5
			Tall dropseed	5
6, 7: Crockett	Favorable	6,000	Little bluestem	10
	Normal	5,000	Indiangrass	10
	Unfavorable	3,000	Virginia wildrye	10
			Florida paspalum	10
			Sideoats grama	10
			Texas needlegrass	10
			Silver bluestem	10
			Paspalum	10
			Big bluestem	5
			Post oak	5
			Blackjack oak	5
9:* Fairlie	Favorable	7,000	Little bluestem	40
	Normal	6,000	Eastern gamagrass	20
	Unfavorable	3,500	Indiangrass	15
			Switchgrass	10
			Sideoats grama	5
			Meadow dropseed	5
Dalco	Favorable	6,000	Little bluestem	50
	Normal	5,000	Indiangrass	25
	Unfavorable	3,500	Switchgrass	5
			Sideoats grama	5
			Vine-mesquite	5

See footnote at end of table.

TABLE 8.--NATIVE GRAZING LAND--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
10 Ferris	Favorable	7,000	Little bluestem	30
	Normal	5,500	Indiangrass	15
	Unfavorable	4,000	Big bluestem	15
			Switchgrass	5
			Florida paspalum	5
			Eastern gamagrass	5
			Virginia wildrye	5
			Sideoats grama	5
			Texas needlegrass	5
			Meadow dropseed	5
11*:				
Ferris	Favorable	7,000	Little bluestem	30
	Normal	5,500	Indiangrass	15
	Unfavorable	4,000	Big bluestem	15
			Switchgrass	5
			Florida paspalum	5
			Eastern gamagrass	5
			Virginia wildrye	5
			Sideoats grama	5
			Texas needlegrass	5
			Meadow dropseed	5
Heiden	Favorable	7,000	Little bluestem	50
	Normal	6,000	Big bluestem	15
	Unfavorable	3,500	Indiangrass	10
12 Gasil	Favorable	6,500	Little bluestem	45
	Normal	4,000	Indiangrass	10
	Unfavorable	3,500	Beaked panicum	10
			Post oak	10
			Virginia wildrye	5
			Blackjack oak	5
13 Heiden	Favorable	7,000	Little bluestem	50
	Normal	6,000	Big bluestem	15
	Unfavorable	3,500	Indiangrass	10
14 Heiden	Favorable	7,000	Little bluestem	50
	Normal	6,000	Big bluestem	15
	Unfavorable	3,500	Indiangrass	10
16 Hopco	Favorable	7,000	Longleaf uniola	15
	Normal	6,000	Virginia wildrye	10
	Unfavorable	3,500	Beaked panicum	10
			Little bluestem	10
			Sedge	10
			Post oak	10
			Florida paspalum	5
			Indiangrass	5
			Eastern gamagrass	5
			Giant cane	5
			Blackjack oak	5
17 Houston Black	Favorable	7,000	Little bluestem	50
	Normal	6,000	Indiangrass	25
	Unfavorable	3,500	Switchgrass	5
			Sideoats grama	5
			Vine-mesquite	5

See footnote at end of table.

TABLE 8.--NATIVE GRAZING LAND--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
18, 19 Kaufman	Favorable	7,500	Virginia wildrye	15
	Normal	6,000	Sedge	10
	Unfavorable	4,000	Beaked panicum	10
			Eastern gamagrass	10
			Panicum	10
			Eastern cottonwood	10
			American elm	10
			Rustyseed paspalum	5
			Switchgrass	5
			Buffalograss	5
			Hackberry	5
20 Lamar	Favorable	6,000	Little bluestem	35
	Normal	4,500	Big bluestem	20
	Unfavorable	3,000	Indiangrass	15
			Switchgrass	5
			Virginia wildrye	5
			Florida paspalum	5
			Texas needlegrass	5
			Silver bluestem	5
21, 22 Leson	Favorable	8,500	Indiangrass	15
	Normal	7,000	Big bluestem	15
	Unfavorable	5,000	Eastern gamagrass	15
			Little bluestem	10
			Switchgrass	10
			Virginia wildrye	5
			Florida paspalum	5
			Sideoats grama	5
			Texas needlegrass	5
			Dropseed	5
24:*				
Lufkin	Favorable	5,000	Little bluestem	40
	Normal	4,000	Indiangrass	10
	Unfavorable	2,500	Brownseed paspalum	10
			Purpletop	5
			Post oak	5
			Blackjack oak	5
Rader	Favorable	6,000	Little bluestem	40
	Normal	4,500	Post oak	10
	Unfavorable	3,500	Indiangrass	5
			Switchgrass	5
			Eastern gamagrass	5
			Paspalum	5
			Purpletop	5
			Beaked panicum	5
			Sedge	5
			Longleaf uniola	5
25 Nahatche	Favorable	5,500	Hairy wildrye	20
	Normal	4,500	Rustyseed paspalum	15
	Unfavorable	3,000	Hairy panicum	10
			Post oak	10
			Panicum	5
			Bentawn plumegrass	5
			Switchcane	5
			Blackjack oak	5

See footnote at end of table.

TABLE 8.--NATIVE GRAZING LAND--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
27----------------- Rader	Favorable	6,000	Little bluestem	40
	Normal	4,500	Post oak	10
	Unfavorable	3,500	Indiangrass	5
			Switchgrass	5
			Eastern gamagrass	5
			Paspalum	5
			Purpletop	5
			Beaked panicum	5
			Sedge	5
			Longleaf uniola	5
28----------------- Stephen	Favorable	4,500	Little bluestem	30
	Normal	3,500	Indiangrass	15
	Unfavorable	2,000	Big bluestem	10
			Sideoats grama	10
			Texas needlegrass	5
			Silver bluestem	5
			Hairy grama	5
29, 30------------- Tinn	Favorable	7,000	Virginia wildrye	15
	Normal	6,000	Sedge	15
	Unfavorable	4,000	Post oak	15
			Eastern gamagrass	10
			Switchgrass	10
			Indiangrass	10
			Giant cane	5
			Beaked panicum	5
			Panicum	5
			Blackjack oak	5
31----------------- Wilson	Favorable	6,000	Little bluestem	45
	Normal	4,500	Indiangrass	10
	Unfavorable	3,000	Big bluestem	10
			Virginia wildrye	5
			Vine-mesquite	5
			Florida paspalum	5
			Sideoats grama	5
			Texas needlegrass	5
			Silver bluestem	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1-----Axtell	Moderate: percs slowly.	Slight-----	Moderate: percs slowly.	Slight-----	Slight.
2-----Axtell	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
3-----Bazette	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: slope.
4-----Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
5-----Burleson	Moderate: percs slowly, too clayey.	Severe: too clayey.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
6, 7-----Crockett	Moderate: percs slowly.	Slight-----	Moderate: slope, percs slowly.	Slight-----	Slight.
8:*					
Crockett-----	Moderate: percs slowly.	Slight-----	Moderate: slope, percs slowly.	Slight-----	Slight.
Urban land.					
9:*					
Fairlie-----	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
Dalco-----	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
10-----Ferris	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey, slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
11:*					
Ferris-----	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.
Heiden-----	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.
12-----Gasil	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope.
13-----Heiden	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
14 Heiden	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
15:* Heiden	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.
Urban land.					
16 Hopco	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods, low strength.
17 Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
18, 19 Kaufman	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey, wetness.	Severe: floods, too clayey.
20 Lamar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
21, 22 Leson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
23:* Leson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
Urban land.					
24:* Lufkin	Severe: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.
Rader	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Slight	Slight.
25 Nahatche	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.
26. Pits					
27 Rader	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, percs slowly, wetness.	Slight	Slight.
28 Stephen	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey, depth to rock.	Moderate: too clayey.	Severe: too clayey, thin layer.
29 Tinn	Severe: wetness, floods, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, floods, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
30 Tinn	Severe: wetness, floods, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, floods, percs slowly.	Severe: wetness, too clayey.	Severe: floods, wetness, too clayey.
31 Wilson	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.
32:*					
Wilson	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Native grazing land wildlife
1: Axtell	Fair	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
2: Axtell	Poor	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
3: Bazette	Poor	Fair	Fair	Good	---	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
4: Branyon	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
5: Burleson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
6, 7: Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
8:*												
Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Urban land.												
9:*												
Fairlie	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
Dalco	Fair	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
10: Ferris	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
11:*												
Ferris	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Heiden	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
12: Gasil	Fair	Good	Good	Fair	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
13, 14: Heiden	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
15:*												
Heiden	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Urban land.												
16: Hopco	Poor	Fair	Fair	Good	---	---	Fair	Fair	Fair	Good	Fair	---
17: Houston Black	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
18: Kaufman	Fair	Fair	Poor	Good	---	Fair	Poor	Good	Fair	Good	Fair	---
19: Kaufman	Poor	Poor	Fair	Good	---	Fair	Poor	Good	Poor	Good	Fair	---

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Native grazing land wildlife
20. Lamar	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
21, 22. Leson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
23:*												
Leson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Urban land.												
24:*												
Lufkin	Fair	Good	Fair	Good	---	---	Fair	Fair	Fair	Good	Fair	---
Rader	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
25. Nahatche	Very poor.	Poor	Fair	Good	---	---	Fair	Fair	Poor	Fair	Fair	---
26. Pits												
27. Rader	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
28. Stephen	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
29. Tinn	Fair	Fair	Fair	Good	---	---	Poor	Fair	Fair	Good	Poor	---
30. Tinn	Poor	Fair	Fair	Good	---	---	Poor	Fair	Fair	Fair	Poor	---
31. Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
32:*												
Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Urban land.												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1----------------- Axtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
2----------------- Axtell	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: slope.
3----------------- Bazette	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
4----------------- Branyon	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
5----------------- Burleson	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
6, 7-------------- Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
8:* Crockett---------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Urban land.						
9:* Fairlie----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Dalco------------	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
10---------------- Ferris	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Severe: too clayey.
11:* Ferris-----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Heiden-----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
12---------------- Gasil	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
13, 14------------ Heiden	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
15:*						
Heiden	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Urban land.						
16 Hopco	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, low strength.
17 Houston Black	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
18, 19 Kaufman	Severe: too clayey, floods, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell, low strength.	Severe: floods, too clayey.
20 Lamar	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Moderate: low strength, shrink-swell, slope.	Moderate: slope.
21, 22 Leson	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
23:*						
Leson	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Urban land.						
24:*						
Lufkin	Severe: wetness, too clayey.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
Rader	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Moderate: low strength, wetness.	Slight.
25 Nahatche	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.	Severe: floods, wetness.
26. Pits						
27 Rader	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Moderate: low strength, wetness.	Slight.
28 Stephen	Severe: too clayey.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: depth to rock.	Severe: too clayey, thin layer.
29 Tinn	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, low strength.	Severe: wetness, too clayey.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
30----------------- Tinn	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, low strength.	Severe: floods, wetness, too clayey.
31----------------- Wilson	Severe: wetness, too clayey.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
32:*						
Wilson-----------	Severe: wetness, too clayey.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Urban land.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Axtell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
2 Axtell	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
3 Bazette	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
4 Branyon	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
5 Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
6, 7 Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
8:*					
Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Urban land.					
9:*					
Fairlie	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: too clayey, depth to rock.	Slight	Fair: too clayey, area reclaim.
Dalco	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
10 Ferris	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
11:*					
Ferris	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
12 Gasil	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.	Fair: too sandy, slope.
13, 14 Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
15:*					
Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Urban land.					
16 Hopco	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods.	Poor: too clayey, wetness.
17 Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18 Kaufman	Severe: percs slowly.	Slight	Severe: floods, too clayey, wetness.	Severe: too clayey, floods.	Poor: too clayey, wetness.
19 Kaufman	Severe: percs slowly.	Slight	Severe: floods, too clayey, wetness.	Severe: too clayey. floods.	Poor: too clayey, wetness.
20 Lamar	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
21, 22 Leson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
23:*					
Leson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Urban land.					
24:*					
Lufkin	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
Rader	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Moderate: wetness.	Poor: thin layer.
25 Nahatche	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
26. Pits					
27 Rader	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Moderate: wetness.	Poor: thin layer.
28 Stephen	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey.
29, 30 Tinn	Severe: wetness, floods, percs slowly.	Severe: floods.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
31 Wilson	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer, wetness.
32:*					
Wilson	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer, wetness.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1, 2 Axtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
3 Bazette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
4 Branyon	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
5 Burleson	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
6, 7 Crockett	Poor: shrink-swell, low strength.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer.
8:				
Crockett	Poor: shrink-swell, low strength.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer.
Urban land.				
9:				
Fairlie	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Dalco	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
10 Ferris	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
11:				
Ferris	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Heiden	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
12 Gasil	Poor: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
13, 14 Heiden	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
15:				
Heiden	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land.				

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
16: Hopco	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, wetness.
17: Houston Black	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
18, 19: Kaufman	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
20: Lamar	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
21, 22: Leson	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
23:				
Leson	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land.				
24:				
Lufkin	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness.
Rader	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
25: Nahatche	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
26. Pits				
27: Rader	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
28: Stephen	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
29, 30: Tinn	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
31: Wilson	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness.
32:				
Wilson	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness.
Urban land.				

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
21, 22. Leson	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
23:* Leson	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
Urban land.					
24:* Lufkin	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Percs slowly, erodes easily, wetness.
Rader	Slight	Moderate: wetness.	Percs slowly	Wetness, percs slowly.	Percs slowly.
25. Nahatche	Moderate: seepage.	Severe: wetness.	Floods	Not needed	Wetness.
26. Pits					
27. Rader	Slight	Moderate: wetness.	Percs slowly	Wetness, percs slowly.	Percs slowly.
28. Stephen	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, percs slowly.	Depth to rock, percs slowly.
29, 30. Tinn	Slight	Severe: wetness.	Percs slowly, floods.	Not needed	Wetness, percs slowly.
31. Wilson	Slight	Severe: wetness.	Percs slowly, wetness.	Percs slowly, wetness, erodes easily.	Percs slowly, wetness, erodes easily.
32:* Wilson	Slight	Severe: wetness.	Percs slowly, wetness.	Percs slowly, wetness, erodes easily.	Percs slowly, wetness, erodes easily.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
1, 2 Axtell	Slight	Moderate: hard to pack.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.
3 Bazette	Severe: slope.	Moderate: hard to pack.	Not needed	Percs slowly, slope.	Percs slowly, slope.
4 Branyon	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
5 Burleson	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
6, 7 Crockett	Slight	Moderate: hard to pack.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily, slope.
8:* Crockett	Slight	Moderate: hard to pack.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily, slope.
Urban land.					
9:* Fairlie	Moderate: depth to rock.	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
Dalco	Moderate: depth to rock.	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
10 Ferris	Slight	Moderate: hard to pack.	Not needed	Percs slowly, slope.	Percs slowly, slope.
11:* Ferris	Slight	Moderate: hard to pack.	Not needed	Percs slowly, slope.	Percs slowly, slope.
Heiden	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
12 Gasil	Moderate: seepage.	Slight	Not needed	Slope, soil blowing.	Slope.
13, 14 Heiden	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
15:* Heiden	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
Urban land.					
16 Hopco	Slight	Severe: wetness.	Floods	Not needed	Wetness, erodes easily.
17 Houston Black	Slight	Moderate: hard to pack.	Not needed	Percs slowly	Percs slowly.
18, 19 Kaufman	Slight	Severe: wetness.	Floods, percs slowly.	Not needed	Percs slowly, wetness.
20 Lamar	Severe: slope.	Slight	Not needed	Favorable	Slope.

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1----------------- Axtell	0-8	Loam------------	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-70	<31	NP-7
	8-15	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-86	41-60	25-40
	15-34	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	34-80	Sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7-6	0-2	85-100	75-100	75-100	36-98	35-60	15-45
2----------------- Axtell	0-9	Loam------------	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-70	<31	NP-7
	9-18	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-86	41-60	25-40
	18-46	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	46-64	Sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7-6	0-2	85-100	75-100	75-100	36-98	35-60	15-45
3----------------- Bazette	0-6	Clay loam-------	CL	A-6, A-7	0	95-100	95-100	85-100	60-90	30-43	11-21
	6-39	Silty clay loam, clay loam, clay.	CL, CH	A-7	0	95-100	95-100	90-100	80-95	48-66	27-40
	39-60	Shaly clay, clay, silty clay loam.	CL, CH	A-7	0	95-100	95-100	90-100	70-95	41-60	20-35
4----------------- Branyon	0-68	Clay------------	CH	A-7-6	0	95-100	75-100	75-100	75-100	60-80	35-55
5----------------- Burleson	0-80	Clay------------	CH, MH	A-7-6	0-2	83-100	80-100	80-100	80-95	51-90	27-55
6----------------- Crockett	0-7	Loam------------	SM, ML, CL, SC	A-4, A-6	0-2	95-100	95-100	90-100	35-98	15-35	3-15
	7-12	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-98	36-60	22-45
	12-53	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	51-90	30-56	11-40
	53-65	Clay loam, sandy clay loam, loam.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-56	11-40
7----------------- Crockett	0-4	Loam------------	SM, ML, CL, SC	A-4, A-6	0-2	95-100	95-100	90-100	35-98	15-35	3-15
	4-12	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6, A-7-6	0	85-100	80-100	75-100	65-98	36-60	22-45
	12-40	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6, A-7-6	0	85-100	80-100	75-100	51-95	30-59	11-42
	40-60	Clay loam, sandy clay loam, loam.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-56	11-40
8:*											
Crockett----------	0-7	Loam------------	SM, ML, CL, SC	A-4, A-6	0-2	95-100	95-100	90-100	35-98	15-35	3-15
	7-12	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6, A-7-6	0	85-100	80-100	75-100	65-98	36-60	22-45
	12-53	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6, A-7-6	0	85-100	80-100	75-100	51-95	30-59	11-42
	53-65	Clay loam, sandy clay loam, loam.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-56	11-40

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
8:* Urban land.											
9:* Fairlie-----------	0-5	Silty clay loam	CH, CL	A-7-6	0	95-100	95-100	90-100	85-100	41-60	25-40
	5-54	Silty clay loam, silty clay, clay.	CH	A-7-6	0	95-100	95-100	90-100	85-100	51-80	28-50
	54-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Dalco-------------	0-31	Silty clay loam, clay.	CH	A-7-6	0	90-100	90-100	85-100	85-98	48-75	31-50
	31-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---
10----------------- Ferris	0-76	Clay------------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
11:* Ferris------------	0-65	Clay------------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
Heiden------------	0-65	Clay------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
12----------------- Gasil	0-19	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	92-99	50-75	20-40	<20	NP-4
	19-72	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	92-100	85-100	36-71	22-40	7-20
13----------------- Heiden	0-78	Clay------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
14----------------- Heiden	0-62	Clay------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
15:* Heiden------------	0-78	Clay------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
Urban land.											
16----------------- Hopco	0-67	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-95	28-43	9-25
17----------------- Houston Black	0-80	Clay------------	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-98	34-73
18----------------- Kaufman	0-70	Clay------------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
19----------------- Kaufman	0-80	Clay------------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
20----------------- Lamar	0-4	Loam------------	CL, CL-ML	A-4	0	95-100	95-100	85-100	51-70	20-30	5-10
	4-60	Loam, clay loam, silty clay loam	CL, CL-ML	A-6, A-4	0	95-100	95-100	85-100	51-80	20-40	5-18
21----------------- Leson	0-58	Clay------------	CH	A-7-6	0	98-100	90-100	90-100	85-100	60-90	35-60
	58-72	Stratified shaly clay.	CH	A-7-6	0	98-100	90-100	90-100	85-100	65-100	40-75
22----------------- Leson	0-42	Clay------------	CH	A-7-6	0	98-100	90-100	90-100	85-100	60-90	35-60
	42-70	Stratified shaly clay.	CH	A-7-6	0	98-100	90-100	90-100	85-100	65-100	40-75

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
23:*											
Leson	0-58	Clay	CH	A-7-6	0	98-100	90-100	90-100	85-100	60-90	35-60
	58-72	Stratified shaly clay.	CH	A-7-6	0	98-100	90-100	90-100	85-100	65-100	40-75
Urban land.											
24:*											
Lufkin	0-8	Loam	SM, CL, CL-ML, SM-SC	A-4	0-5	90-100	80-100	80-100	40-85	<30	NP-10
	8-50	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	90-100	90-100	90-100	70-95	45-67	30-47
	50-80	Clay, clay loam, sandy clay loam.	CH, CL, SC	A-7	0	70-100	70-100	55-100	44-90	45-86	25-55
Rader	0-20	Loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	30-74	18-28	3-10
	20-27	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	27-70	Sandy clay, clay	SC, CH, CL	A-6, A-7 A-7-6	0	90-100	90-100	85-100	51-90	36-60	18-40
	70-80	Sandy clay loam, sandy clay, clay.	SC, CL CL-CH	A-6, A-7 A-7-6	0	90-100	90-100	75-100	36-83	30-50	11-36
25 Nahatche	0-9	Loam	CL	A-6, A-7, A-4	0	100	100	90-100	70-80	25-45	11-25
	9-60	Stratified loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	11-25
26. Pits											
27 Rader	0-22	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	30-74	18-28	3-10
	22-34	Sandy clay loam, loam, clay loam.	SC, CL CL-CH	A-6, A-7-6	0	90-100	90-100	80-100	36-88	26-50	11-32
	34-70	Sandy clay, clay	SC, CH, CL	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-40
	70-80	Sandy clay loam, sandy clay, clay.	SC, CL	A-6, A-7 A-7-6	0	90-100	90-100	75-100	36-83	30-50	11-36
28 Stephen	6-12	Silty clay	CL, CH	A-7-6	0-5	85-100	85-100	85-100	80-90	45-66	22-42
	12-17	Variable	---	---	---	---	---	---	---	---	---
	17-21	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
29 Tinn	0-60	Clay	CH, CL	A-7	0	100	98-100	85-100	80-95	45-65	25-40
30 Tinn	0-76	Clay	CH, CL	A-7	0	100	98-100	85-100	80-95	45-65	25-40

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
31----------------- Wilson	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	6-80	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	38-63	21-48
32:* Wilson------------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	6-80	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	38-63	21-48
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
1----------------- Axtell	0-8	7-18	0.6-2.0	0.11-0.15	5.1-6.5	Low-----------	0.43	5	<1
	8-15	40-55	<0.06	0.13-0.18	4.5-7.3	High----------	0.37		
	15-34	40-55	<0.06	0.13-0.15	5.1-7.1	High----------	0.37		
	34-80	25-50	0.2-0.6	0.13-0.18	5.6-8.4	High----------	0.37		
2----------------- Axtell	0-9	7-18	0.6-2.0	0.11-0.15	5.1-6.5	Low-----------	0.43	5	<1
	9-18	40-55	<0.06	0.13-0.18	4.5-7.3	High----------	0.37		
	18-46	40-55	<0.06	0.13-0.15	5.1-7.1	High----------	0.37		
	46-64	25-50	0.2-0.6	0.13-0.18	5.6-8.4	High----------	0.37		
3----------------- Bazette	0-6	20-35	0.06-2.0	0.15-0.20	5.6-7.3	Low-----------	0.32	3	1-3
	6-39	35-55	0.06-0.2	0.14-0.18	5.6-7.8	High----------	0.37		
	39-60	30-55	0.06-0.2	0.14-0.18	6.1-8.4	High----------	0.37		
4----------------- Branyon	0-68	45-60	<0.06	0.15-0.18	7.9-8.4	Very high-----	0.32	5	1-4
5----------------- Burleson	0-80	40-60	<0.06	0.12-0.18	5.6-8.4	High----------	0.32	5	1-3
6----------------- Crockett	0-7	8-20	0.6-2.0	0.11-0.20	5.6-7.3	Low-----------	0.43	5	1-2
	7-12	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	12-53	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	53-65	15-45	0.06-0.2	0.15-0.20	7.4-8.4	Moderate------	0.32		
7----------------- Crockett	0-4	8-20	0.6-2.0	0.11-0.20	5.6-7.3	Low-----------	0.43	5	1-2
	4-12	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	12-40	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	40-60	15-45	0.06-0.2	0.15-0.20	7.4-8.4	Moderate------	0.32		
8:*									
Crockett---------	0-7	8-20	0.6-2.0	0.11-0.20	5.6-7.3	Low-----------	0.43	5	1-2
	7-12	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	12-53	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	53-65	15-45	0.06-0.2	0.15-0.20	7.4-8.4	Moderate------	0.32		
Urban land.									
9:*									
Fairlie----------	0-5	32-50	<0.06	0.14-0.20	7.4-8.4	Very high-----	0.32	5	1-4
	5-54	35-60	<0.06	0.14-0.20	7.4-8.4	Very high-----	0.32		
	54-60	---	---	---	---	--------------	---		
Dalco------------	0-31	13-60	<0.06	0.12-0.18	7.4-8.4	Very high-----	0.32	3	1-4
	31-38	---	---	---	---	--------------	---		
10---------------- Ferris	0-76	40-60	<0.06	0.15-0.18	7.9-8.4	Very high-----	0.32	4	1-2
11:*									
Ferris-----------	0-65	40-60	<0.06	0.15-0.18	7.9-8.4	Very high-----	0.32	4	1-2
Heiden-----------	0-65	40-60	<0.06	0.15-0.20	7.9-8.4	Very high-----	0.32	5	1-4
12---------------- Gasil	0-19	5-12	6.0-20	0.07-0.11	6.1-7.8	Low-----------	0.20	5	<1
	19-72	15-35	0.6-2.0	0.12-0.19	5.1-6.5	Moderate------	0.32		
13---------------- Heiden	0-78	40-60	<0.06	0.15-0.20	7.9-8.4	Very high-----	0.32	5	1-4
14---------------- Heiden	0-62	40-60	<0.06	0.15-0.20	7.9-8.4	Very high-----	0.32	5	1-4

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
15:*									
Heiden	0-78	40-60	<0.06	0.15-0.20	7.9-8.4	Very high	0.32	5	1-4
Urban land.									
16 Hopco	0-67	25-35	0.2-0.6	0.18-0.22	6.6-8.4	Moderate	0.37	5	1-4
17 Houston Black	0-80	40-60	<0.06	0.15-0.20	7.4-8.4	Very high	0.32	5	1-4
18 Kaufman	0-70	40-80	0.06-0.2	0.15-0.20	5.6-8.4	High	0.32	5	1-4
19 Kaufman	0-80	40-80	0.06-0.2	0.15-0.20	5.6-8.4	High	0.32	5	1-4
20 Lamar	0-4	18-27	0.6-2.0	0.12-0.15	6.6-8.4	Low	0.32	4	1-3
	4-60	20-35	0.6-2.0	0.12-0.15	6.6-8.4	Moderate	---		
21 Leson	0-58	40-60	<0.06	0.12-0.18	6.1-8.4	High	0.32	4	1-3
	58-72	40-60	<0.06	0.12-0.18	7.4-8.4	High	---		
22 Leson	0-42	40-60	<0.06	0.12-0.18	6.1-8.4	High	0.32	4	1-3
	42-70	40-60	<0.06	0.12-0.18	7.4-8.4	High	---		
23:*									
Leson	0-58	40-60	<0.06	0.12-0.18	6.1-8.4	High	0.32	4	1-3
	58-72	40-60	<0.06	0.12-0.18	7.4-8.4	High	---		
Urban land.									
24:*									
Lufkin	0-8	15-25	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	5	1-2
	8-50	35-50	<0.06	0.12-0.18	5.1-7.8	Very high	0.32		
	50-80	35-50	<0.06	0.10-0.14	6.1-8.4	High	0.37		
Rader	0-20	5-20	2.0-6.0	0.10-0.15	4.5-6.5	Low	0.32	5	1-2
	20-27	18-30	0.2-0.6	0.12-0.18	4.5-5.5	Moderate	0.32		
	27-70	35-50	<0.06	0.12-0.18	4.5-6.5	High	0.32		
	70-80	30-45	0.06-0.2	0.12-0.18	4.5-7.8	Moderate	0.32		
25 Nahatche	0-9	18-35	0.6-2.0	0.10-0.15	5.1-7.8	Moderate	0.28	5	1-3
	9-60	18-35	0.6-2.0	0.10-0.15	5.1-7.8	Moderate	0.28		
26. Pits									
27 Rader	0-22	5-20	2.0-6.0	0.10-0.15	4.5-6.5	Low	0.32	5	1-2
	22-34	18-30	0.2-0.6	0.12-0.18	4.5-5.5	Moderate	0.32		
	34-70	35-50	<0.06	0.12-0.18	4.5-6.5	High	0.32		
	70-80	30-45	0.06-0.2	0.12-0.18	4.5-7.8	Moderate	0.32		
28 Stephen	0-6	35-50	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	0.32	1	1-3
	6-12	---	---	---	---	---	---		
	12-18	---	---	---	---	---	---		
29 Tinn	0-60	35-60	0.06-0.2	0.15-0.20	7.4-8.4	High	0.32	5	1-4
30 Tinn	0-76	35-60	0.06-0.2	0.15-0.20	7.4-8.4	High	0.32	5	1-4
31 Wilson	0-6	20-27	0.2-0.6	0.15-0.20	5.6-7.3	Low	0.43	5	1-2
	6-80	35-50	<0.06	0.14-0.20	5.6-8.4	High	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and Soil name	Depth	Clay	Permeability	Available water capacity	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
32:*									
Wilson----------	0-6	20-27	0.2-0.6	0.15-0.20	5.6-7.3	Low-----------	0.43	5	1-2
	6-80	35-50	<0.06	0.14-0.20	5.6-8.4	High----------	0.37		
Urban land.									

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that the data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
1, 2 Axtell	D	None	---	---	>6.0	---	---	>60	---	High	Moderate.
3 Bazette	C	None	---	---	>6.0	---	---	>60	---	High	Low.
4 Branyon	D	None	---	---	>6.0	---	---	>60	---	High	Low.
5 Burleson	D	None	---	---	>6.0	---	---	>60	---	High	Low.
6, 7 Crockett	D	None	---	---	>6.0	---	---	>60	---	High	Low.
8:* Crockett	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Urban land.											
9:* Fairlie	D	None	---	---	>6.0	---	---	40-60	Rippable	High	Low.
Dalco	D	None	---	---	>6.0	---	---	24-40	Rippable	High	Low.
10 Ferris	D	None	---	---	>6.0	---	---	>60	---	High	Low.
11:* Ferris	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
12 Gasil	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
13, 14 Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
15:* Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Urban land.											
16 Hopco	C	Frequent	Brief	Dec-May	0.5-1.0	Apparent	Dec-May	>60	---	High	Low.
17 Houston Black	D	None	---	---	>6.0	---	---	>60	---	High	Low.
18 Kaufman	D	Occasional	Brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
19 Kaufman	D	Frequent	Brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
20 Lamar	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
21, 22: Leson	D	None	---	---	>6.0	---	---	40-80	Rippable	High	Low.
23:* Leson	D	None	---	---	>6.0	---	---	40-80	Rippable	High	Low.
Urban land.											
24:* Lufkin	D	None	---	---	0-1.0	Perched	Oct-Mar	>60	---	High	Moderate.
Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
25: Nahatche	C	Frequent	Brief to long.	Nov-May	0-1.5	Apparent	Nov-May	>60	---	High	Moderate.
26. Pits											
27: Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
28: Stephen	C	None	---	---	>6.0	---	---	7-20	Rippable	High	Low.
29: Tinn	D	Occasional	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High	Low.
30: Tinn	D	Frequent	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High	Low.
31: Wilson	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---	High	High.
32:* Wilson	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---	High	High.
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification: AASHTO	Classification: Unified	Grain size distribution: Percentage passing sieve: 3/8 inch	No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: .02 mm	.005 mm	.002 mm	Liquid limit	Plasticity index[1]	Particle density	Shrinkage: Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Axtell loam:[2] (S75TX-231-009)																
A1--------0 to 4	A-4 (00)	ML	100	100	100	100	70	--	9	6	23	3	2.61	20.0	1.6	1.7
B21t------8 to 15	A-7-6(27)	CL	100	100	100	100	86	--	47	43	49	30	2.66	11.0	17.0	1.9
B3-------53 to 80	A-6 (20)	CL	100	100	100	100	81	--	30	25	40	26	2.62	14.0	12.6	1.9
Crockett loam:[3] (S75TX-231-008)																
A1--------0 to 7	A-6 (10)	CL	100	100	100	99	96	--	23	17	31	11	2.62	21.0	5.0	1.6
B21t------7 to 14	A-7-6(39)	CH	100	100	100	100	98	--	49	45	55	36	2.64	14.0	17.8	1.9
B23tca---26 to 48	A-7-6(43)	CH	100	99	98	97	95	--	53	43	59	42	2.67	12.0	20.1	2.0
Dalco silty clay loam:[4] (S75TX-231-004)																
Ap--------0 to 5	A-6 (21)	CL	100	100	100	99	90	--	33	28	40	23	2.63	15.0	12.3	1.8
A12-------5 to 14	A-7-6(29)	CL	100	100	100	99	91	--	44	38	48	31	2.66	12.0	16.2	1.9
AC-------14 to 31	A-7-6(28)	CL	100	100	97	94	84	--	45	38	49	33	2.70	12.0	17.7	2.0
Fairlie silty clay loam:[5] (S75TX-231-006)																
Ap--------0 to 5	A-7-6(26)	CL	100	100	100	100	95	--	35	32	43	26	2.66	15.0	13.2	1.8
A12-------5 to 24	A-7-6(34)	CH	100	100	99	97	92	--	41	37	54	35	2.68	12.0	17.5	1.9
AC-------35 to 54	A-7-6(44)	CH	100	98	96	94	88	--	46	41	64	47	2.70	11.0	21.7	2.0
Hopco silty clay loam:[6] (S75TX-231-007)																
A12-------7 to 32	A-6 (21)	CL	100	100	100	100	93	--	32	25	39	22	2.61	18.0	10.0	1.7
Houston Black clay:[7] (S75TX-231-002)																
Ap--------0 to 7	A-7-6(66)	CH	100	100	100	99	98	--	76	68	84	58	2.68	16.0	24.0	1.8
Ac1------40 to 56	A-7-6(83)	CH	100	100	100	99	98	--	79	71	96	73	2.74	10.0	29.1	2.0
C--------64 to 80	A-7-6(79)	CH	100	100	100	100	99	--	85	73	93	69	2.73	15.0	26.7	1.9
Leson clay:[8] (S75TX-231-005)																
A12-------6 to 28	A-7-6(44)	CH	100	100	100	99	90	--	65	59	65	45	2.68	11.0	22.2	2.0
C--------58 to 72	A-7-6(54)	CH	100	100	99	92	85	--	77	74	81	58	2.82	13.0	24.5	1.9

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit	Plasticity index[1]	Particle density	Shrinkage		
			Percentage passing sieve					Percentage smaller than--								
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Lufkin loam:[9] (S75TX-231-011)																
A1--------0 to 4	A-4 (01)	CL-ML	100	100	100	100	80	--	11	7	24	4	2.59	21.0	1.6	1.6
B21tg-----8 to 25	A-7-6(29)	CL	100	100	100	100	91	--	49	42	47	31	2.65	11.0	16.8	2.0
Rader loam:[10] (S75TX-231-010)																
A1--------0 to 6	A-4 (01)	CL-ML	100	100	100	100	72	--	8	4	23	4	2.60	18.0	3.0	1.7
B1-------11 to 20	A-4 (01)	CL-ML	100	100	100	100	74	--	16	13	22	4	2.63	19.0	1.5	1.7
B22t-----27 to 40	A-7-6(29)	CL-CH or CL	100	100	100	100	88	--	47	45	50	32	2.64	12.0	17.0	1.9
B24t-----70 to 80	A-7-6(30)	CL-CH or CL	100	100	100	100	83	--	36	34	50	36	2.64	13.0	16.8	1.9
Wilson silt loam:[11] (S75TX-231-001)																
Ap--------0 to 6	A-6 (08)	CL	100	100	100	100	83	--	26	17	28	12	2.62	17.0	6.1	1.8
B21tg-----6 to 15	A-7-6(32)	CL-CH or CH	100	100	100	100	90	--	51	44	50	34	2.67	11.0	17.6	2.0
B3g------64 to 80	A-7-6(47)	CH	100	100	100	100	92	--	51	45	63	48	2.68	10.0	21.9	2.0

[1]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[2]Axtell loam: 1.6 miles east on Farm Road 2947 from Farm Road 2101, 0.3 mile east on paved road, 0.5 mile south on oil road, 0.5 mile south-southwest to slope on draw.

[3]Crockett loam: 2 miles northeast of Lone Oak on Farm Road 1567, 0.4 mile east on private road, 0.5 mile north-northeast in pasture.

[4]Dalco silty clay loam: 3 miles southeast of Wolfe City on Texas Highway 11, 1.8 miles south on county road, 300 feet east.

[5]Fairlie silty clay loam: 3 miles southeast of Wolfe City on Texas Highway 11, 1.8 miles south on county road, 0.8 mile west on county road, 0.1 mile south on turnrow, 40 feet east.

[6]Hopco silty clay loam: 2 miles south of junction of Texas Highway 24 and Texas Highway 50, 80 feet west of Texas Highway 50.

[7]Houston Black clay: 2.9 miles north of Caddo Mills on Farm Road 36, 0.9 mile east on county road, 0.1 mile north on county road, 55 feet west in cultivated field.

[8]Leson clay: 0.5 mile north of Quinlan on Texas Highway 34, 0.6 mile east on oil-topped road, 250 feet north of road in idle field.

[9]Lufkin loam: 1.6 miles east on Farm Road 2947 from Farm Road 2101, 0.3 mile east on paved road, 0.5 mile south on oil road, 300 feet east on road.

[10]Rader loam: 1.6 miles east on Farm Road 2947 from Farm Road 2101, 0.3 mile east on paved road, 0.5 mile south on oil road, 300 feet east of road, on a mound.

[11]Wilson silt loam: 1.1 miles north on Texas Highway 34 from junction with Farm Road 2101, 0.2 mile east on private road, 200 feet north in cultivated field.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Axtell	Fine, montmorillonitic, thermic Udertic Paleustalfs
Bazette	Fine, montmorillonitic, thermic Udic Haplustalfs
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Dalco	Fine, montmorillonitic, thermic Udic Pellusterts
Fairlie	Fine, montmorillonitic, thermic Udic Pellusterts
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
*Gasil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Hopco	Fine-silty, mixed, thermic Cumulic Haplaquolls
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Lamar	Fine-silty, mixed, thermic Typic Ustochrepts
Leson	Fine, montmorillonitic, thermic Udic Pellusterts
Lufkin	Fine, montmorillonitic, thermic Vertic Albaqualfs
Nahatche	Fine-loamy, mixed, nonacid, thermic Aeric Fluvaquents
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Stephen	Clayey, mixed, thermic, shallow Entic Haplustolls
Tinn	Fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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NRCS Accessibility Statement

LEGEND

CLAYEY AND LOAMY SOILS ON UPLANDS

- **1** Leson-Houston Black: Clayey, deep, gently sloping, moderately well drained soils
- **2** Ferris-Heiden: Clayey, deep, gently sloping to strongly sloping, well drained soils
- **3** Fairlie-Dalco: Loamy, deep and moderately deep, gently sloping, moderately well drained soils

LOAMY SOILS ON UPLANDS

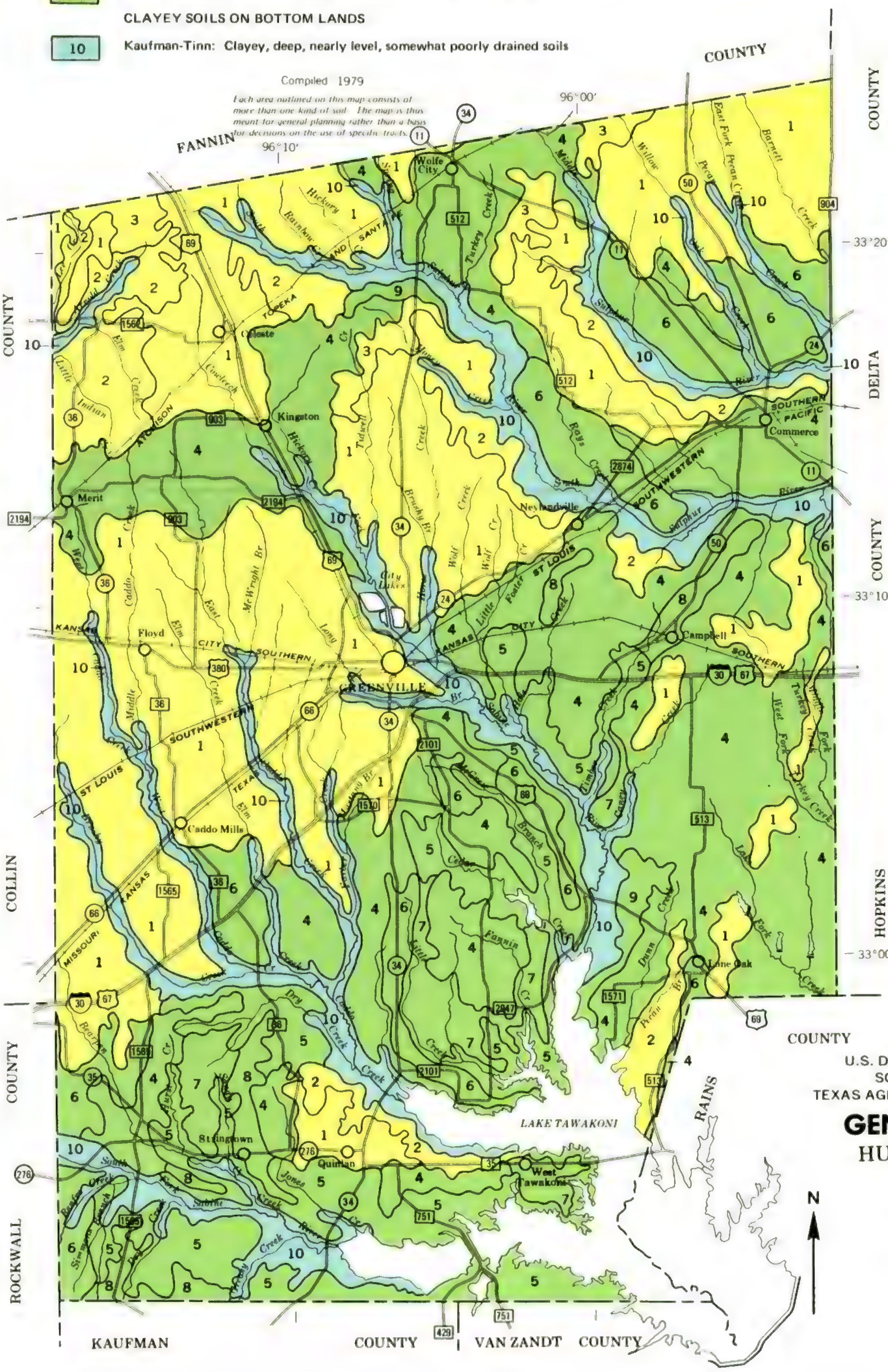
- **4** Crockett: Loamy, deep, gently sloping, moderately well drained soils
- **5** Axtell: Loamy, deep, gently sloping to strongly sloping, moderately well drained soils
- **6** Wilson: Loamy, deep, nearly level, somewhat poorly drained soils
- **7** Lufkin-Rader: Loamy, deep, nearly level, moderately well drained and somewhat poorly drained soils
- **8** Rader: Loamy, deep, nearly level and gently sloping, moderately well drained soils
- **9** Lamar: Loamy, moderately deep, sloping and strongly sloping, well drained soils

CLAYEY SOILS ON BOTTOM LANDS

- **10** Kaufman-Tinn: Clayey, deep, nearly level, somewhat poorly drained soils

Compiled 1979

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
HUNT COUNTY, TEXAS

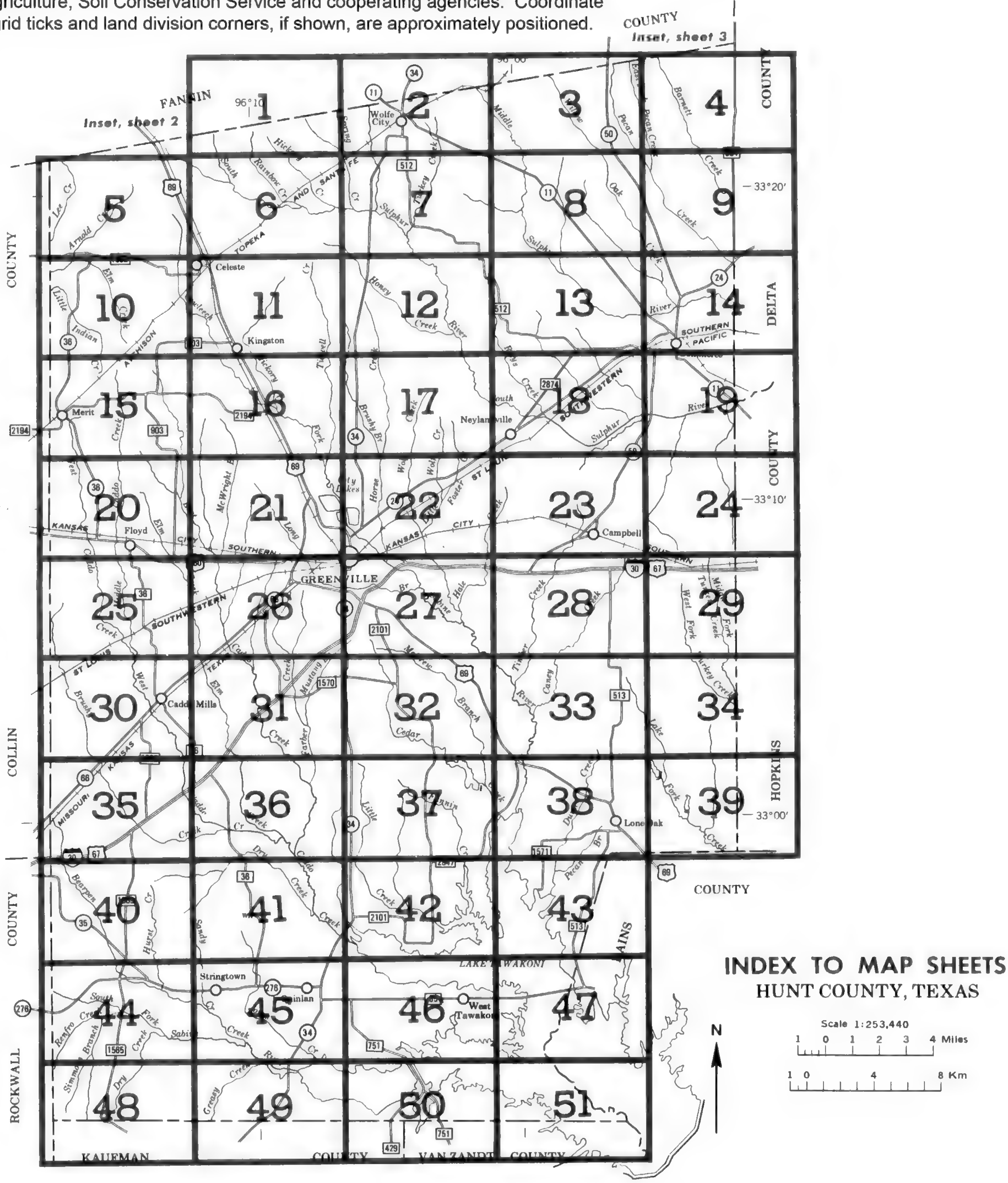
Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

N

Original text from each individual map sheet read:
This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedin Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB, WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

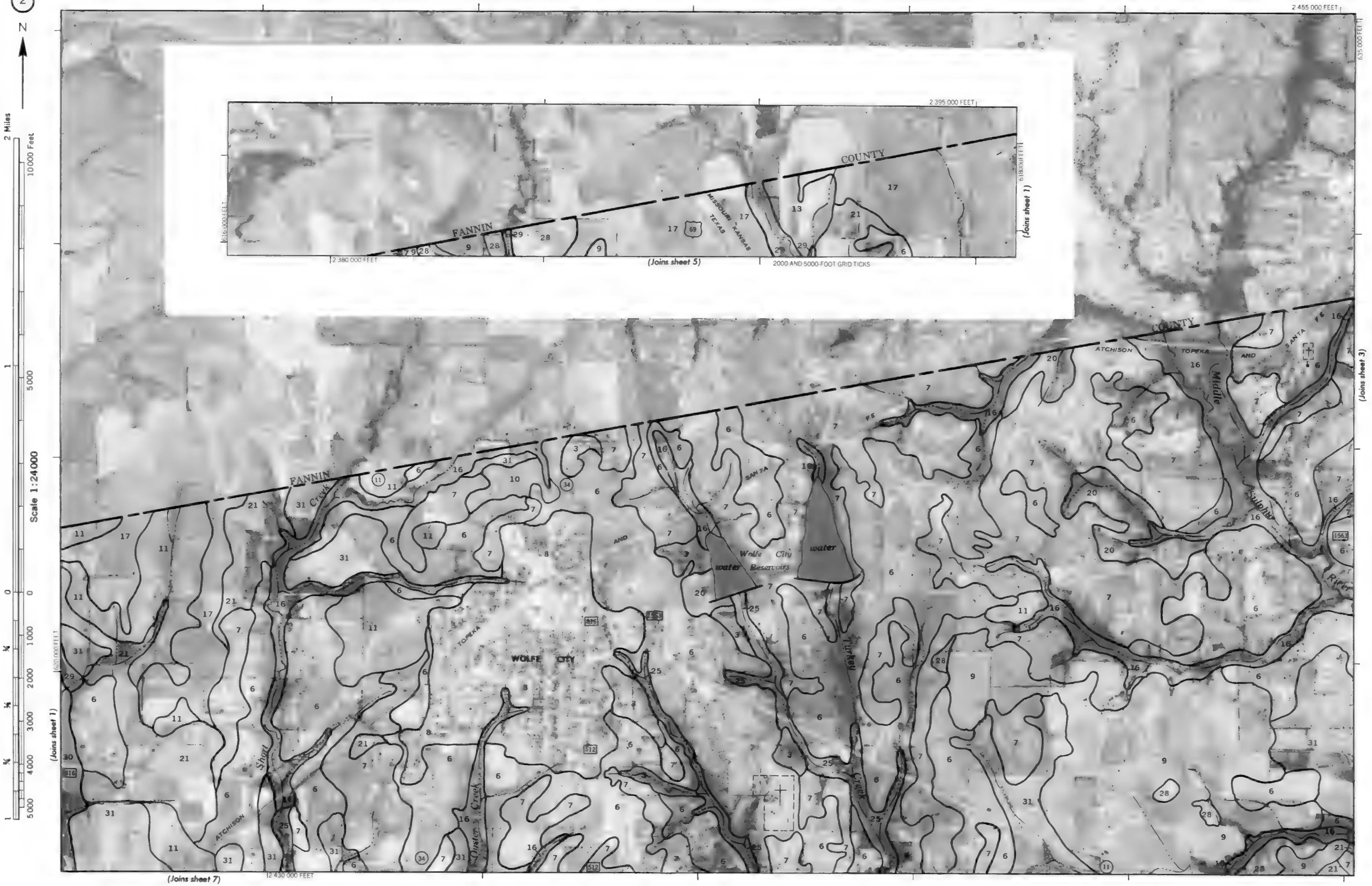
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

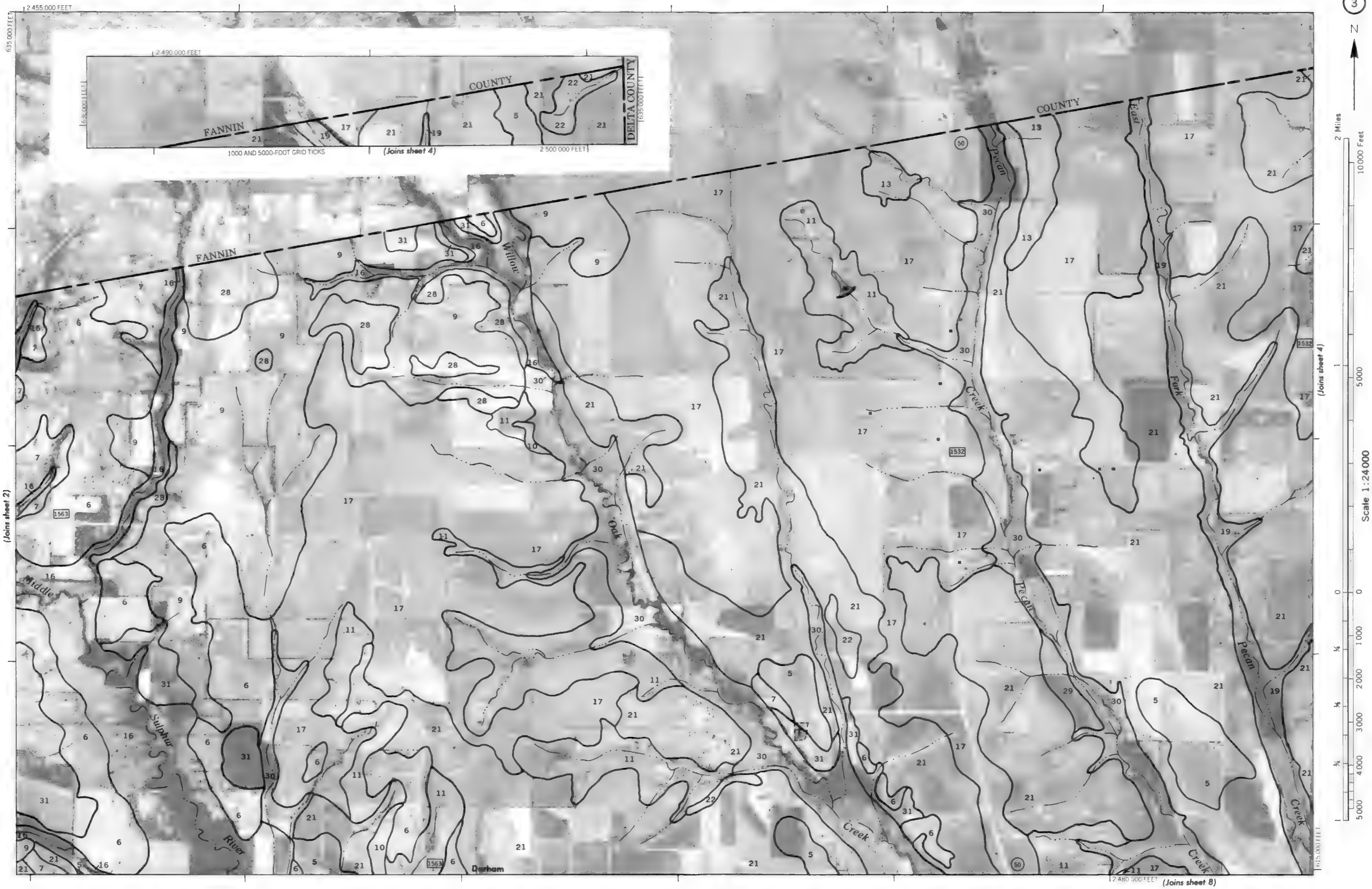
SOIL LEGEND

SYMBOL	NAME
1	Axtell loam, 2 to 5 percent slopes
2	Axtell loam, 5 to 12 percent slopes
3	Bazette clay loam, 5 to 12 percent slopes
4	Branyon clay, 0 to 1 percent slopes
5	Burleson clay, 0 to 1 percent slopes
6	Crockett loam, 1 to 3 percent slopes
7	Crockett loam, 2 to 5 percent slopes, eroded
8	Crockett-Urban land complex, 1 to 3 percent slopes
9	Fairlie and Dalco soils, 1 to 4 percent slopes
10	Ferris clay, 5 to 12 percent slopes, eroded
11	Ferris-Heiden complex, 2 to 5 percent slopes, eroded
1[redacted]	Gasil loamy fine sand, 8 to 12 percent slopes
13	Heiden clay, 2 to 5 percent slopes
14	Heiden clay, 5 to 8 percent slopes
15	Heiden-Urban land complex, 3 to 6 percent slopes
16	Hopco silt loam, frequently flooded
17	Houston Black clay, 1 to 3 percent slopes
1[redacted]	Kaufman clay, occasionally flooded
1[redacted]	Kaufman clay, frequently flooded
20	Lamar loam, 5 to 12 percent slopes
21	Leson clay, 1 to 3 percent slopes
22	Leson clay, 3 to 5 percent slopes
23	Leson-Urban land complex, 1 to 3 percent slopes
24	Lufkin-Rader complex
25	Nahatche loam, frequently flooded
26	Pits
27	Rader fine sandy loam, 1 to 3 percent slopes
28	Stephen silty clay, 2 to 5 percent slopes
29	Tinn clay, occasionally flooded
30	Tinn clay, frequently flooded
31	Wilson silt loam, 0 to 1 percent slopes
32	Wilson-Urban land complex, 0 to 1 percent slopes

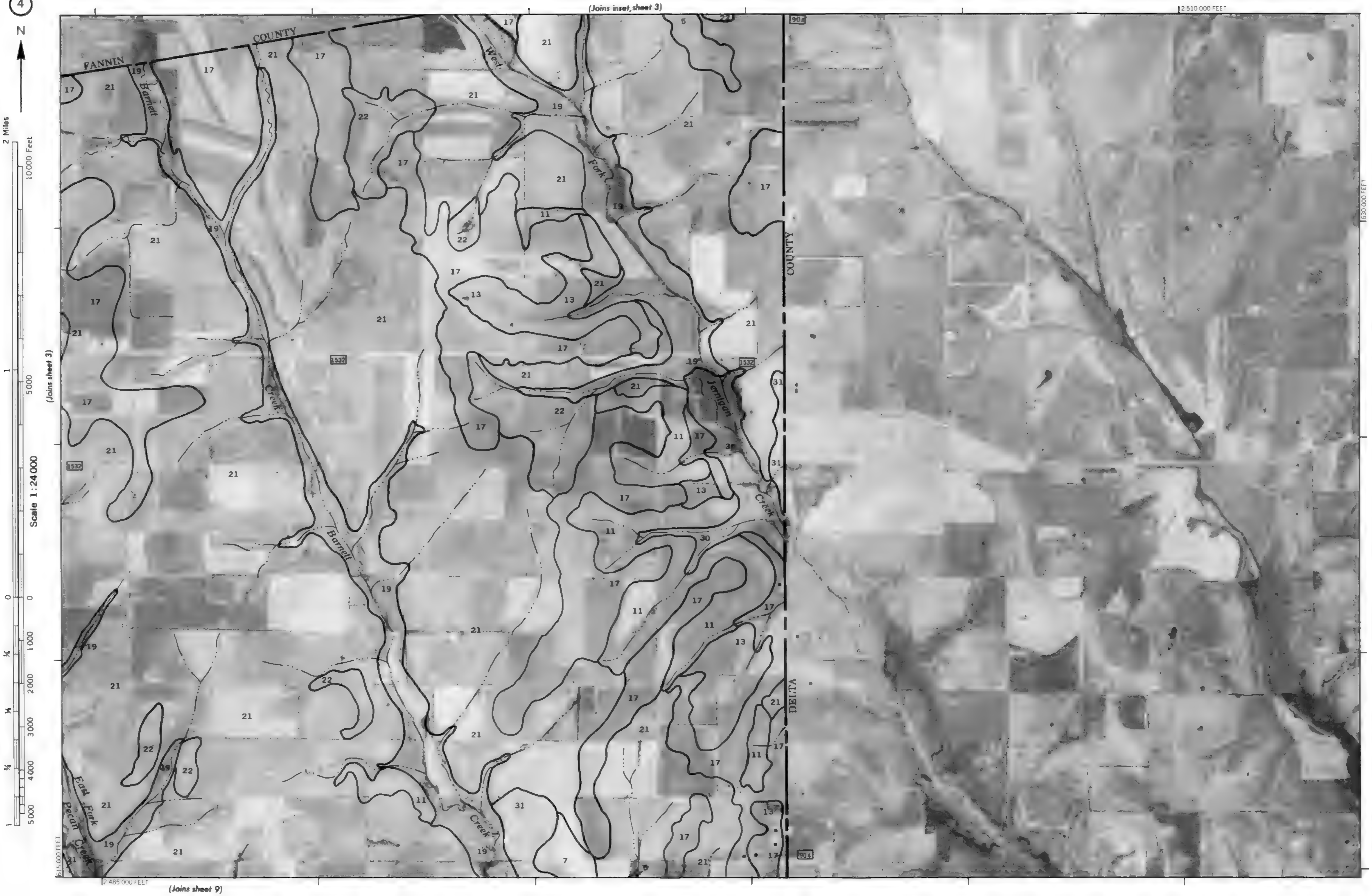
HUNT COUNTY, TEXAS — SHEET NUMBER 1

HUNT COUNTY, TEXAS — SHEET NUMBER 2

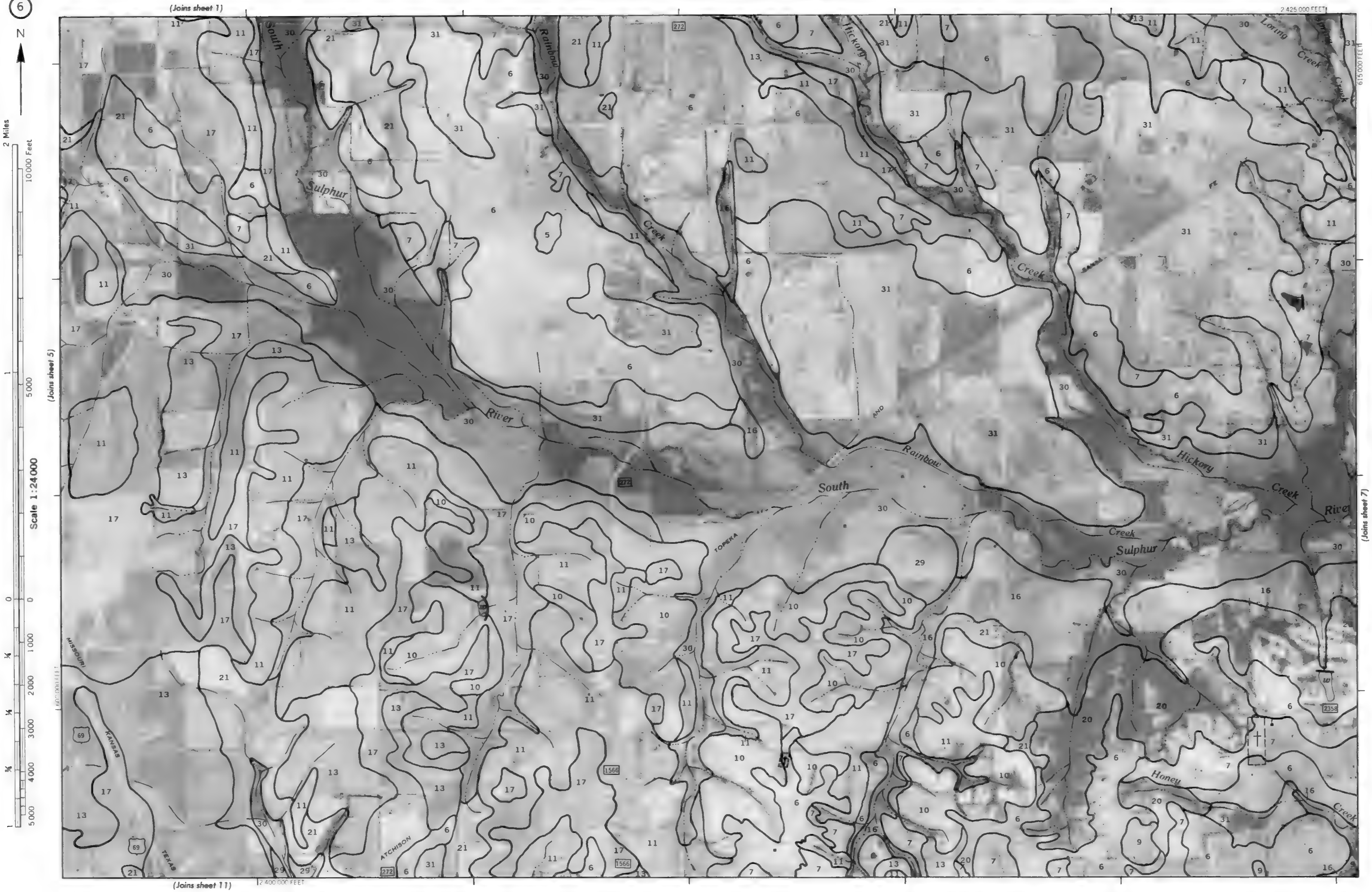


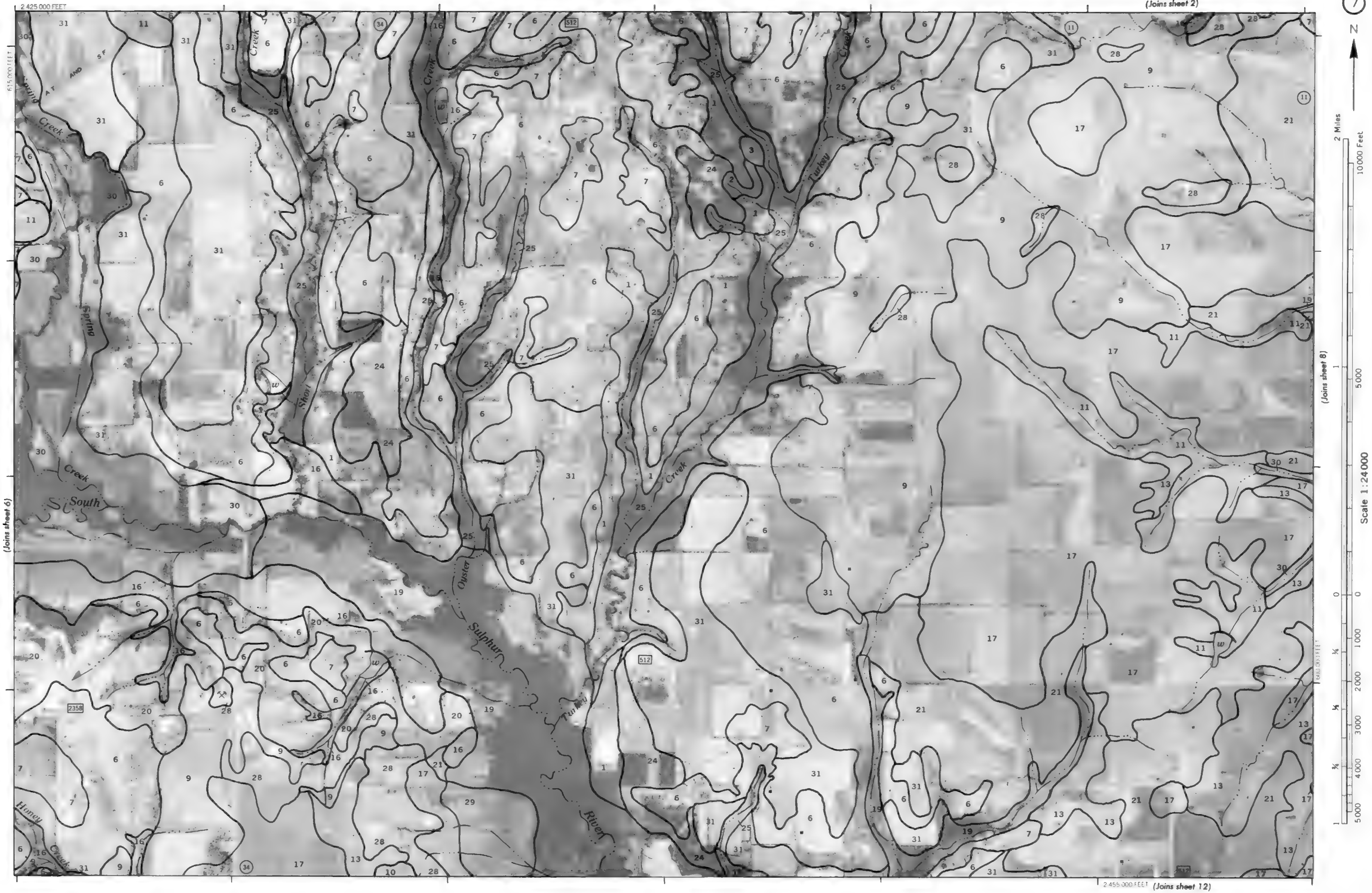

2 455 000 FEET
635 000 FEET
2 490 000 FEET
FANNIN
COUNTY
DELTA COUNTY
1000 AND 5000-FOOT GRID TICKS
(Joins sheet 4)
2 500 000 FEET
FANNIN
COUNTY
Willow
Oak
Creek
Pecan
East
Fork
Middle
Sulphur
River
Durham
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 8)
2 480 000 FEET
615 000 FEET
N
2 Miles
10000 Feet
Scale 1:24000

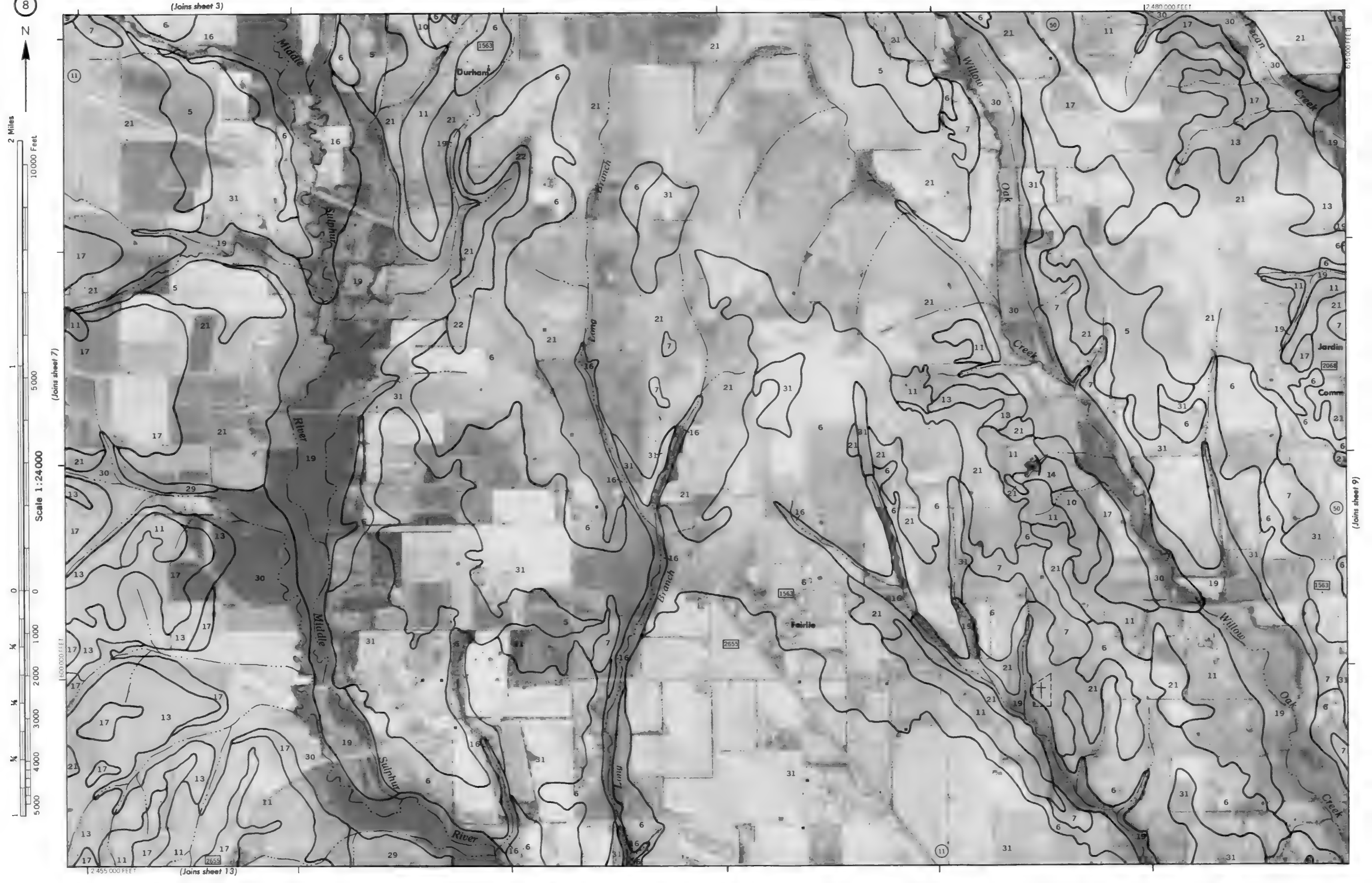
HUNT COUNTY, TEXAS — SHEET NUMBER 4

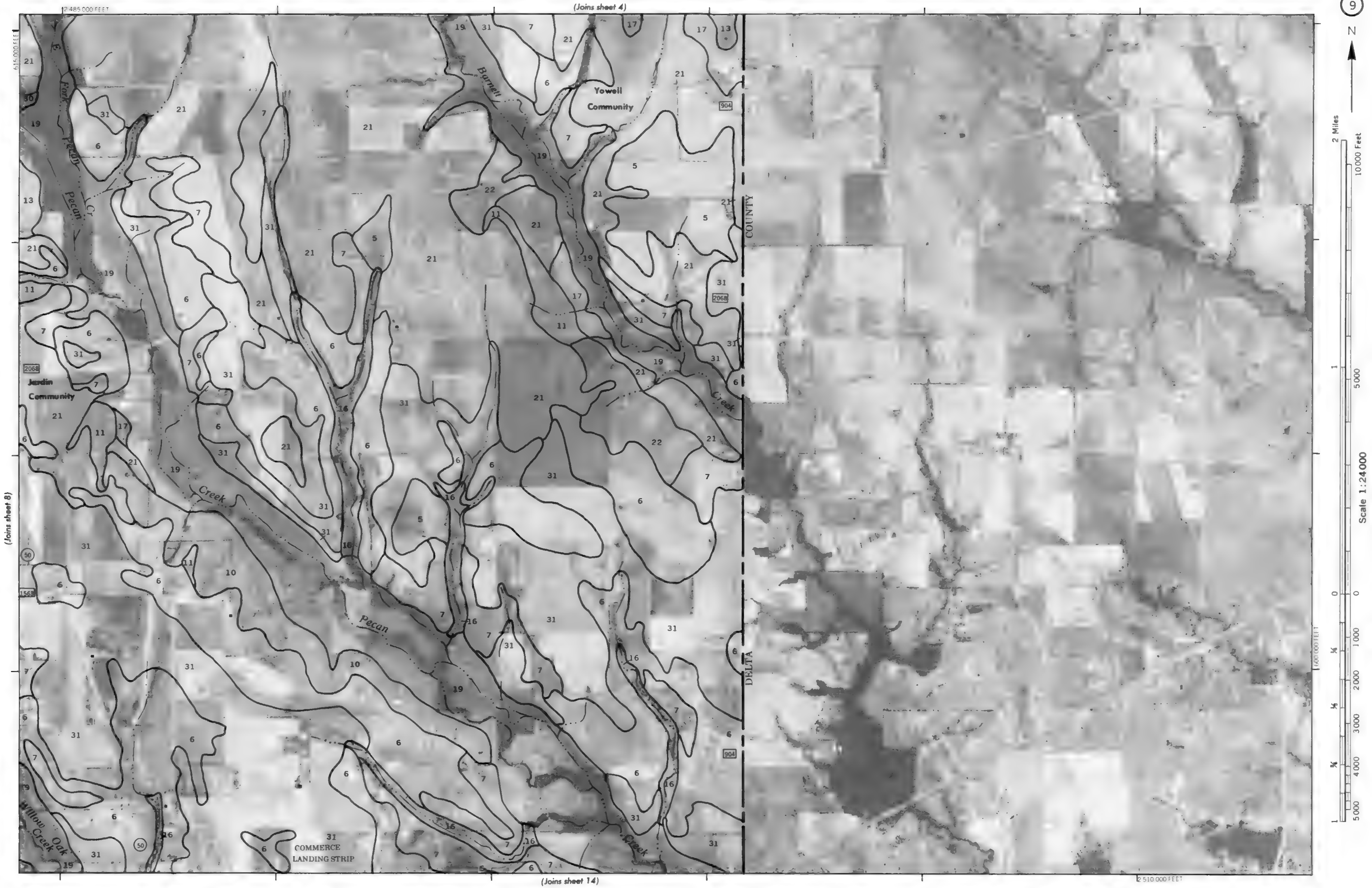


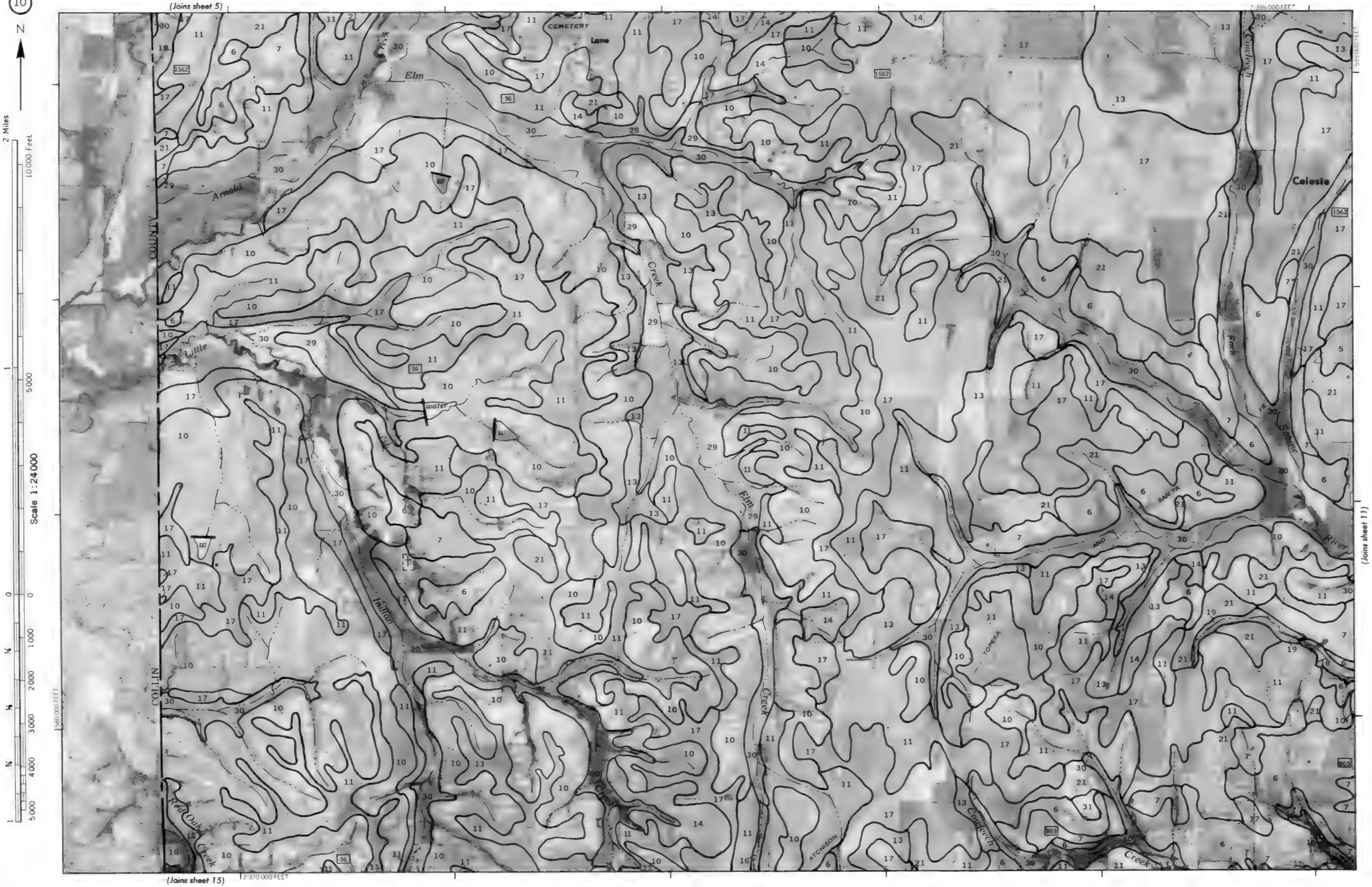

(Joins inset, sheet 2)
5
N
FANNIN COUNTY
COLLIN COUNTY
Lee Creek
Arnold Creek
Creek
Arnold
Lee
water
Cowleech Fork Sabine River
MISSOURI
KANSAS
TEXAS
69
1562
(Joins sheet 6)
(Joins sheet 10)
Scale 1:24000
2 Miles
10000 Feet
2 370 000 FEET
2 395 000 FEET


6
N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 1)
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 11)
2 425 000 FEET
615 000 FEET
2 400 000 FEET
South Sulphur River
Rainbow Creek
Hickory Creek
Loring Creek
Honey Creek
Sulphur Creek
MISSOURI
KANSAS
TEXAS
ATCHISON
TOPEKA
AND
FE

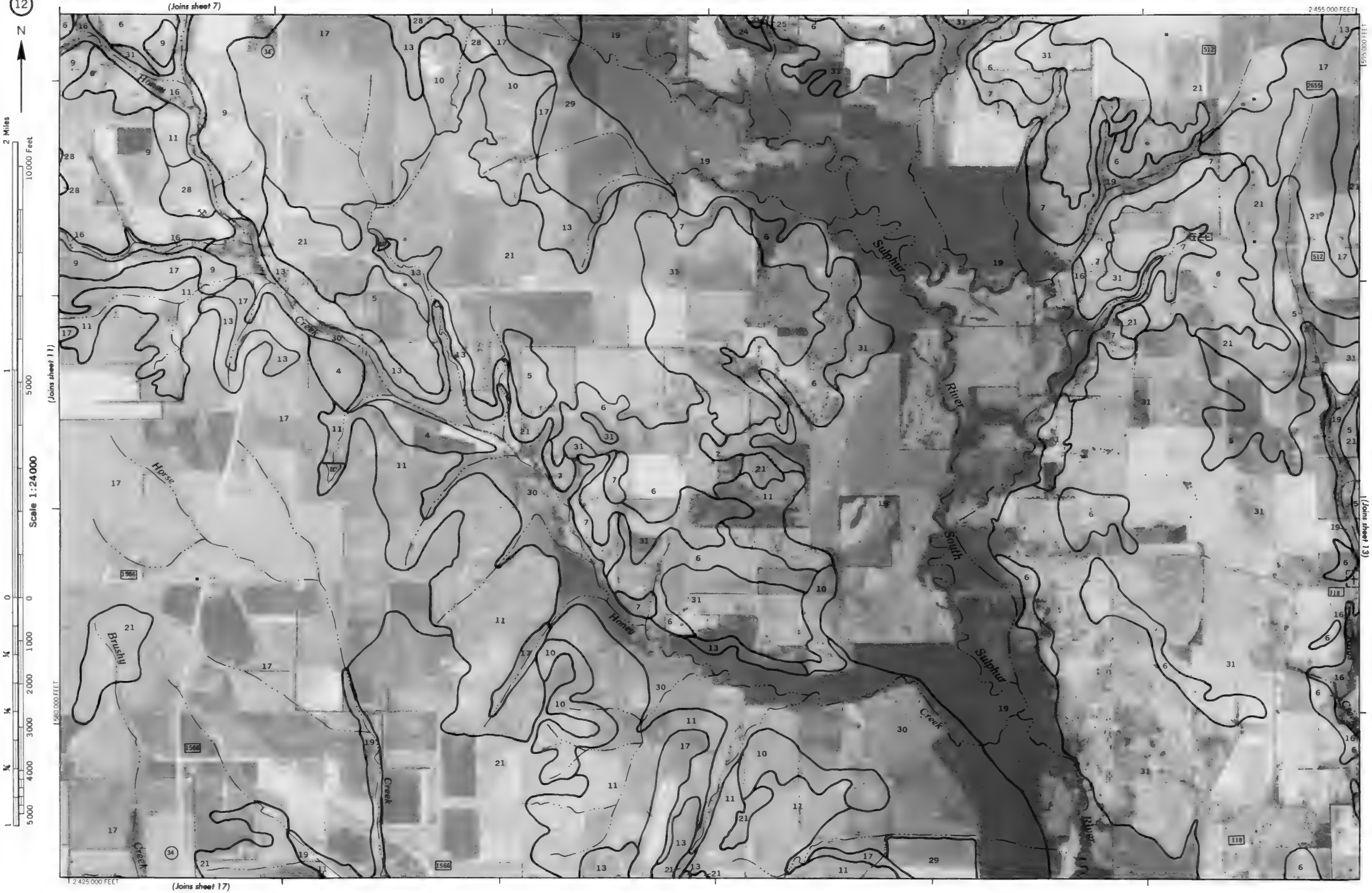

7
(Joins sheet 2)
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 12)
2 425 000 FEET
2 455 000 FEET
N
Scale 1:24 000
2 Miles
10 000 Feet
Sulphur
River
Oyster
Creek
South
Spring
Turkey
Short
Honey
A T AND S F

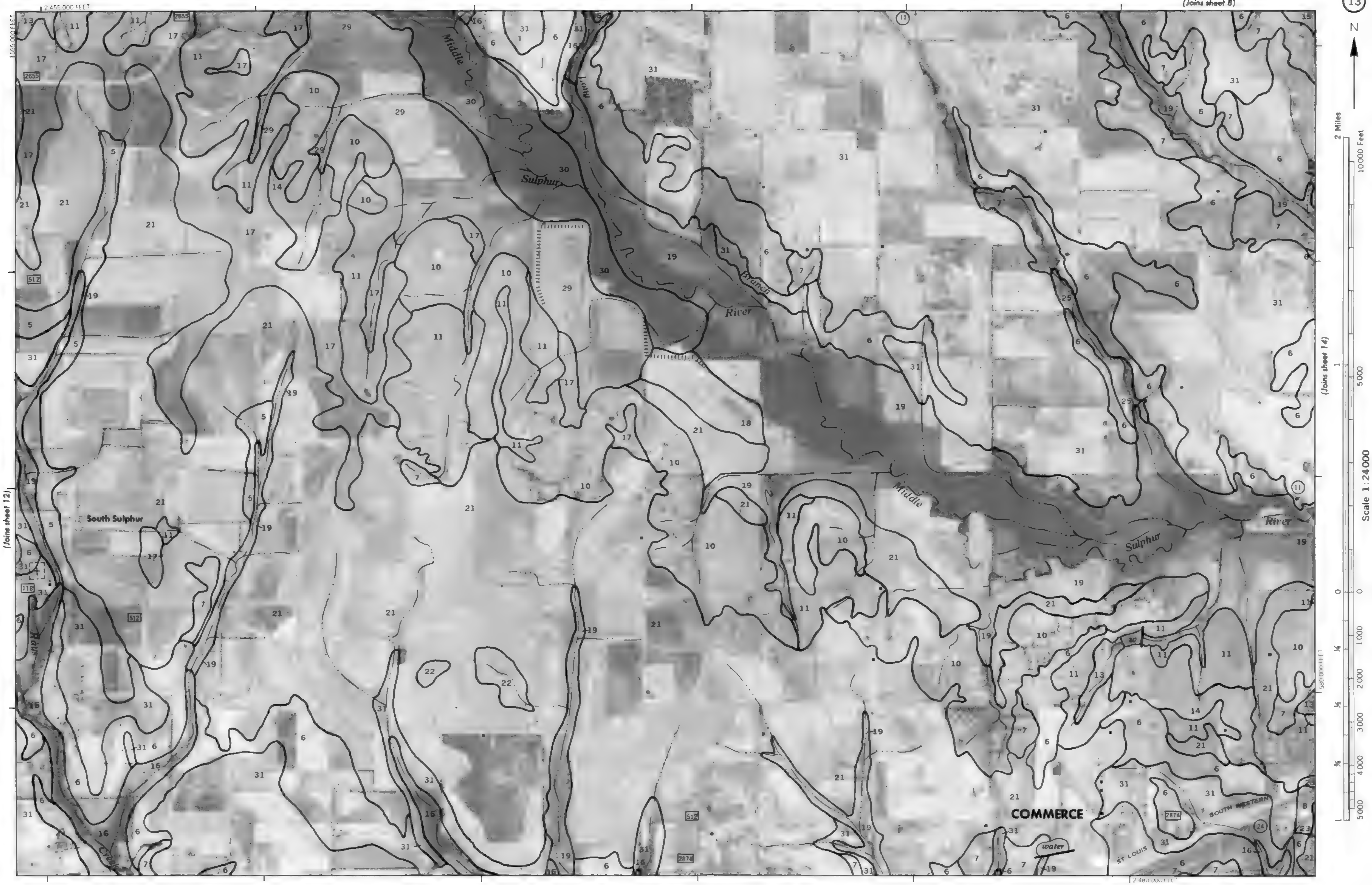

8
N
(Joins sheet 3)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
2 Miles
10000 Feet
5000
Scale 1:24000
2 480 000 FEET
2 455 000 FEET
Durham
Fairlie
Jardin
Middle Sulphur River
Long Branch
Willow Oak Creek
Pecan Creek
1563
2655
2068
11
50

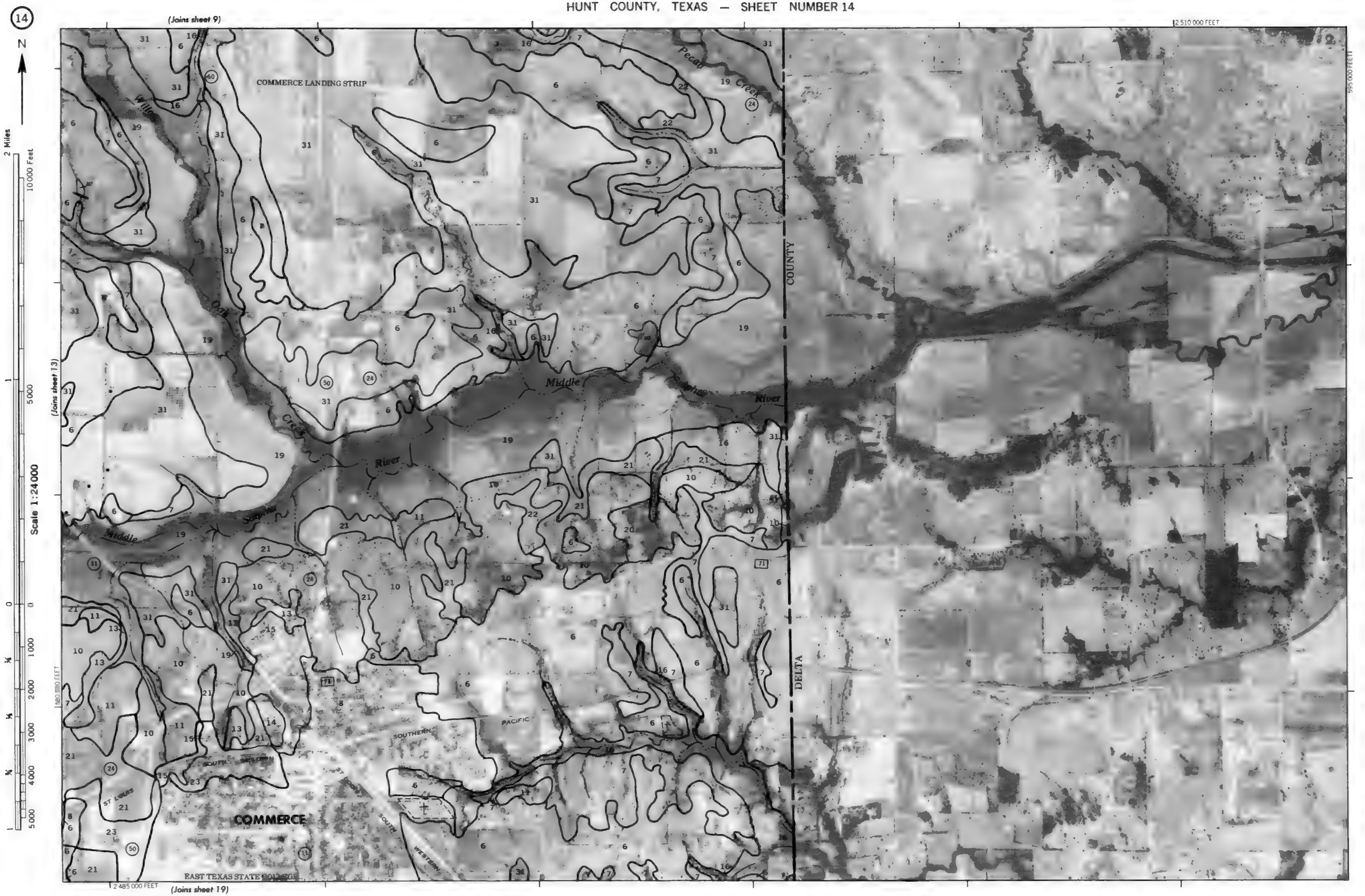

9
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 14)
2 485 000 FEET
2 510 000 FEET
Yowell Community
Jardin Community
COMMERCE LANDING STRIP
DELTA COUNTY
Barnett
Fork
Pecan Cr
Pecan Creek
Creek
Willow Oak Creek
N
Scale 1:24000
2 Miles
10000 Feet


(Joins sheet 5)
(Joins sheet 11)
(Joins sheet 15)
N
2 Miles
10 000 Feet
Scale 1:24 000
2 395 000 FEET
2 370 000 FEET
580 000 FEET
COLLIN COUNTY
CEMETERY
Lane
Celeste
Elm
Elm Creek
Arnold
Little
Indian
Red Oak Creek
Cowleech Fork
Cowleech Creek
Sabine River
SANTA FE
TOPEKA
ATCHISON
water
1562
36
903

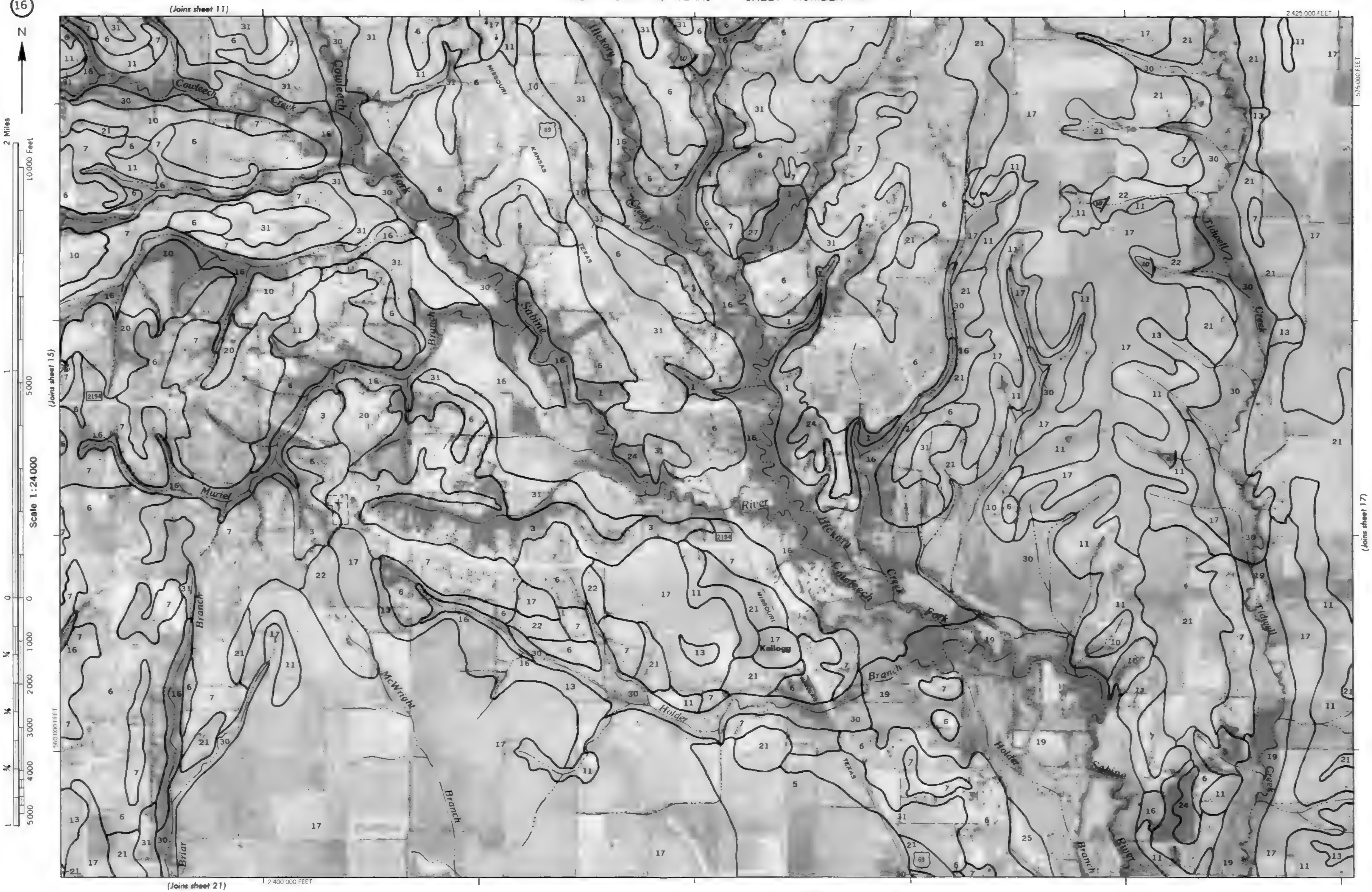

11
(Joins sheet 6)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 16)
N
2 Miles
Scale 1:24000
10 000 Feet
Celeste
Hickory
Creek
Cowleech
Fork
Sabine
River
Kingston
Tidwell
Creek
water
White
Rock
Community
MISSOURI
KANSAS
TEXAS
ATCHISON
TOPEKA
SANTA FE

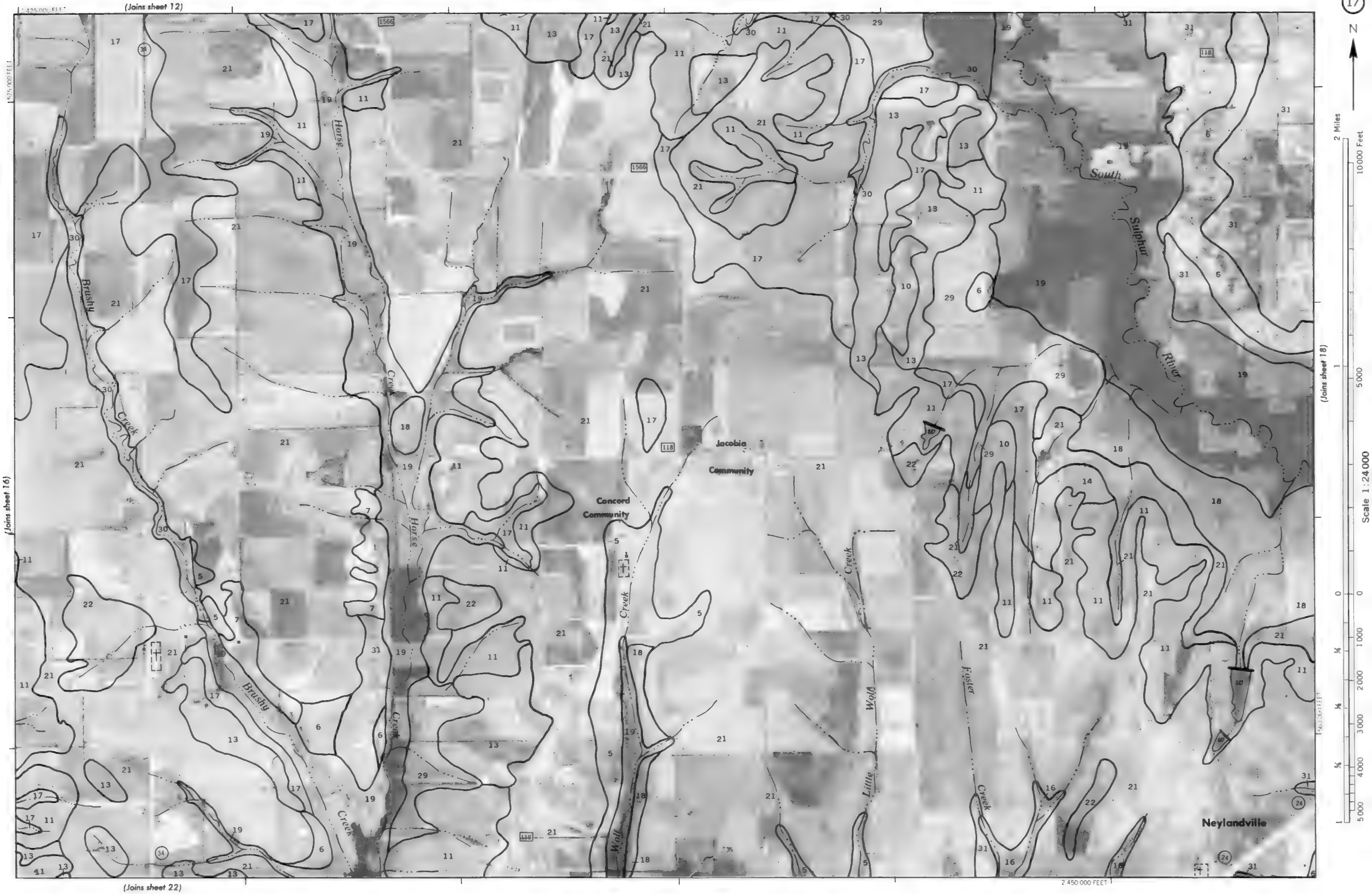

(Joins sheet 7)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 17)
N
Scale 1:24000
2 Miles
10 000 Feet
5000
1000
2000
3000
4000
2 455 000 FEET
595 000 FEET
580 000 FEET
2 425 000 FEET
Honey Creek
Horse Creek
Brushy Creek
Sulphur River
South Sulphur River
Creek
34
512
2655
1566
118

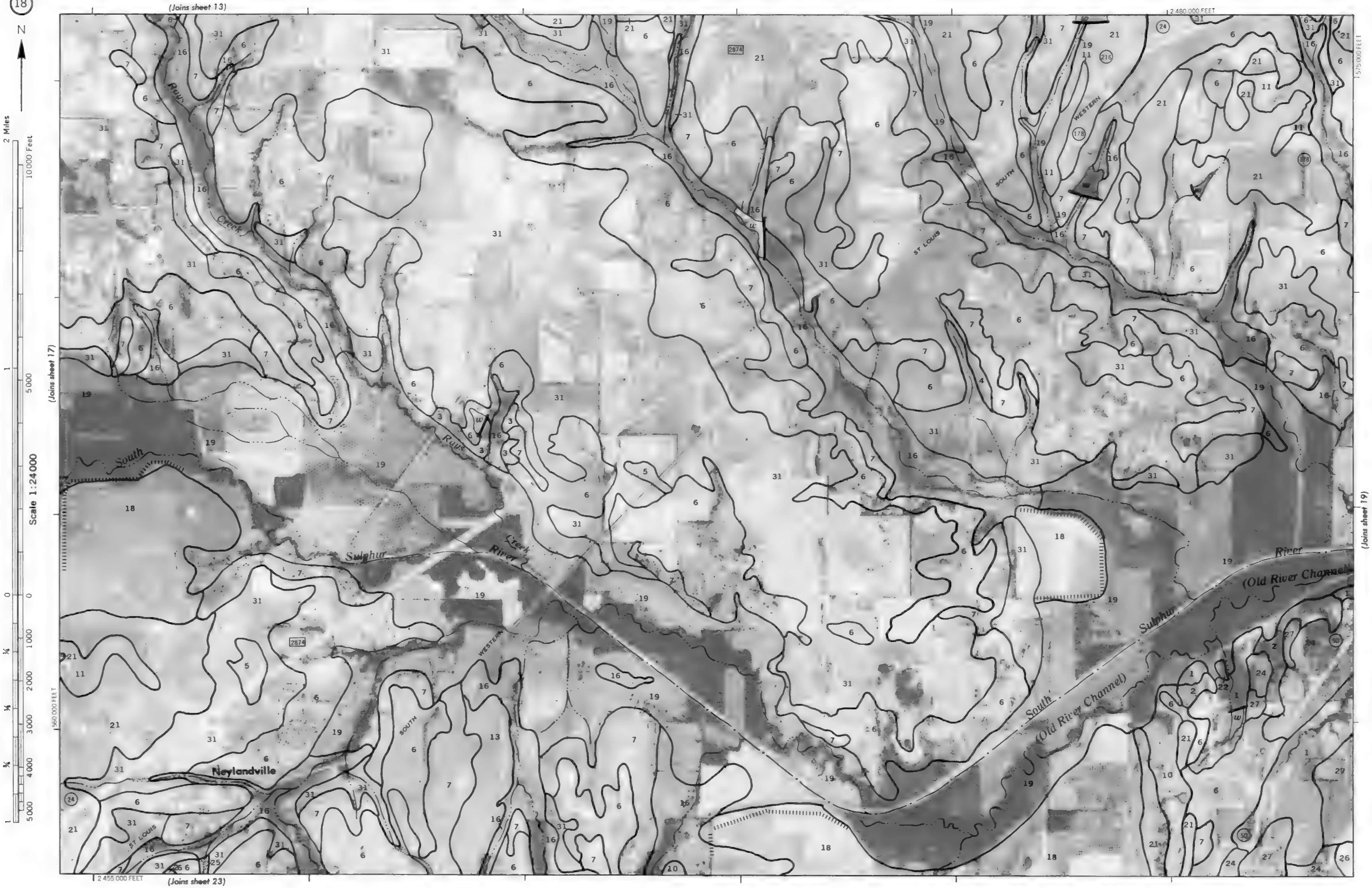

13
(Joins sheet 8)
(Joins sheet 14)
(Joins sheet 12)
N
2 Miles
10000 Feet
Scale 1:24 000
Middle
Sulphur
River
Branch
South Sulphur
COMMERCE
water
ST LOUIS
SOUTH WESTERN
2 455 000 FEET
2 480 000 FEET

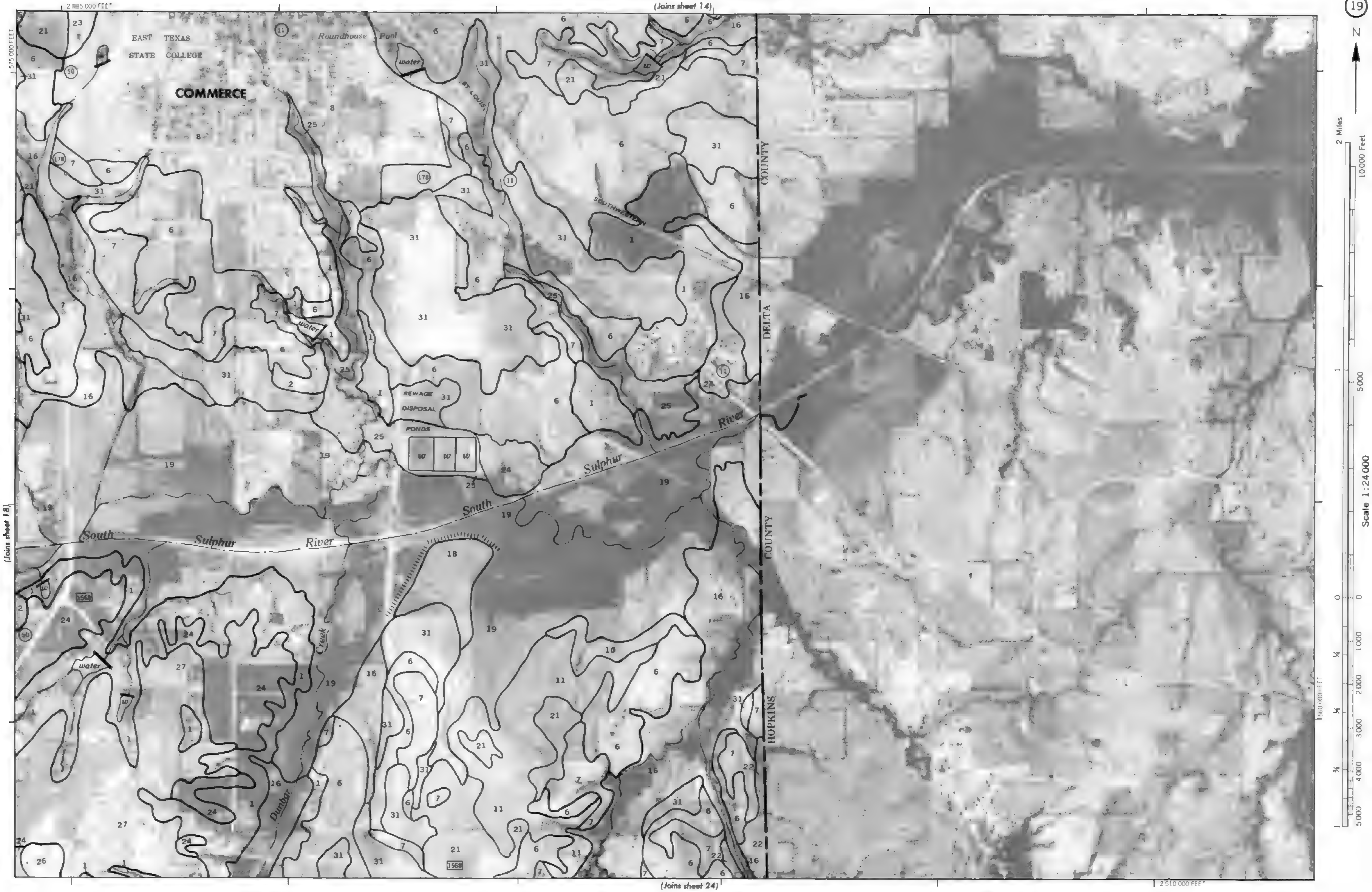

14
N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 9)
(Joins sheet 13)
(Joins sheet 19)
COMMERCE LANDING STRIP
Pecan Creek
Oak Creek
Middle Sulphur River
COUNTY
DELTA
SOUTHERN
PACIFIC
WESTERN
COMMERCE
EAST TEXAS STATE COLLEGE
2 485 000 FEET
2 510 000 FEET
595 000 FEET

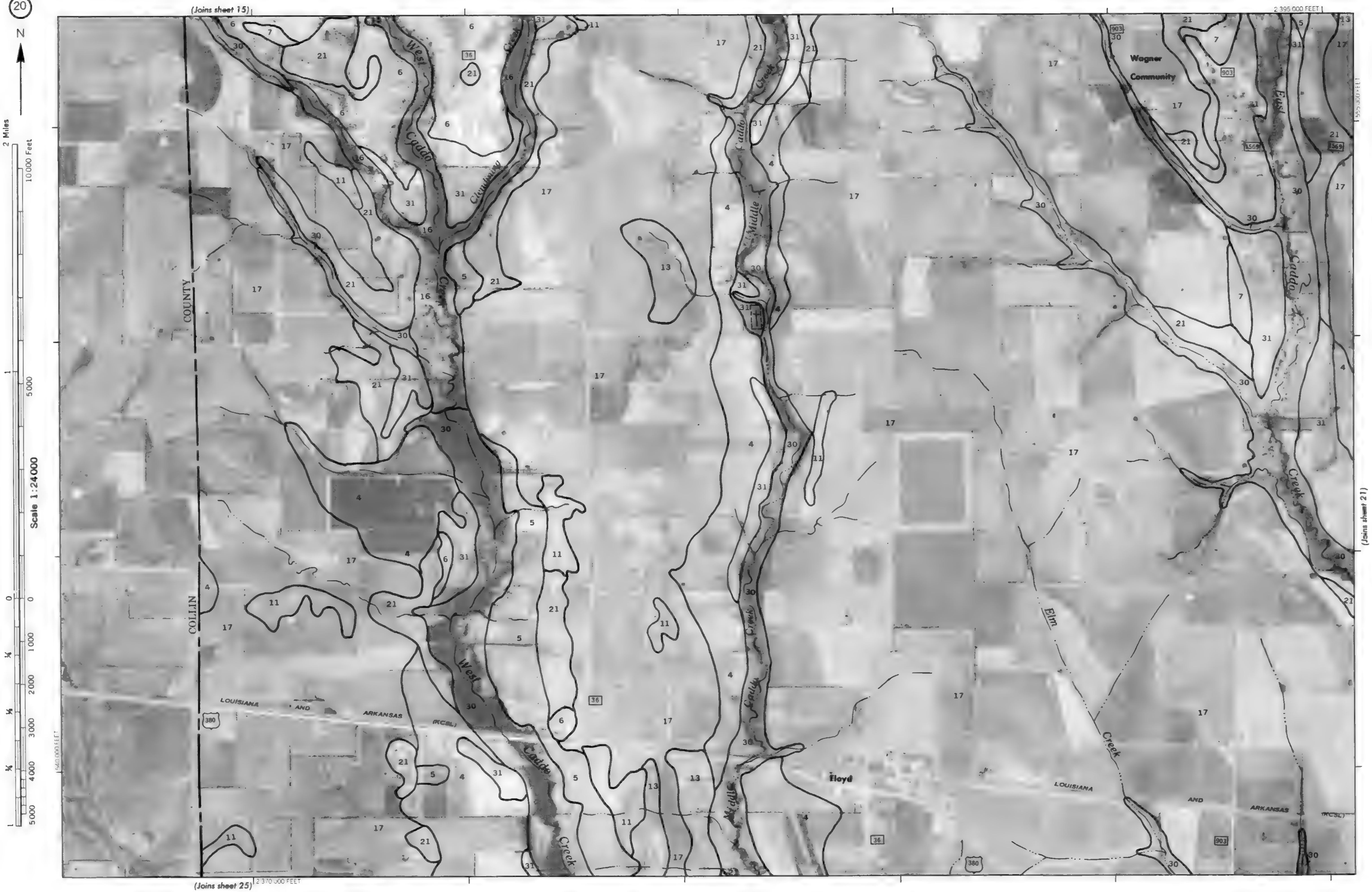
HUNT COUNTY, TEXAS — SHEET NUMBER 15

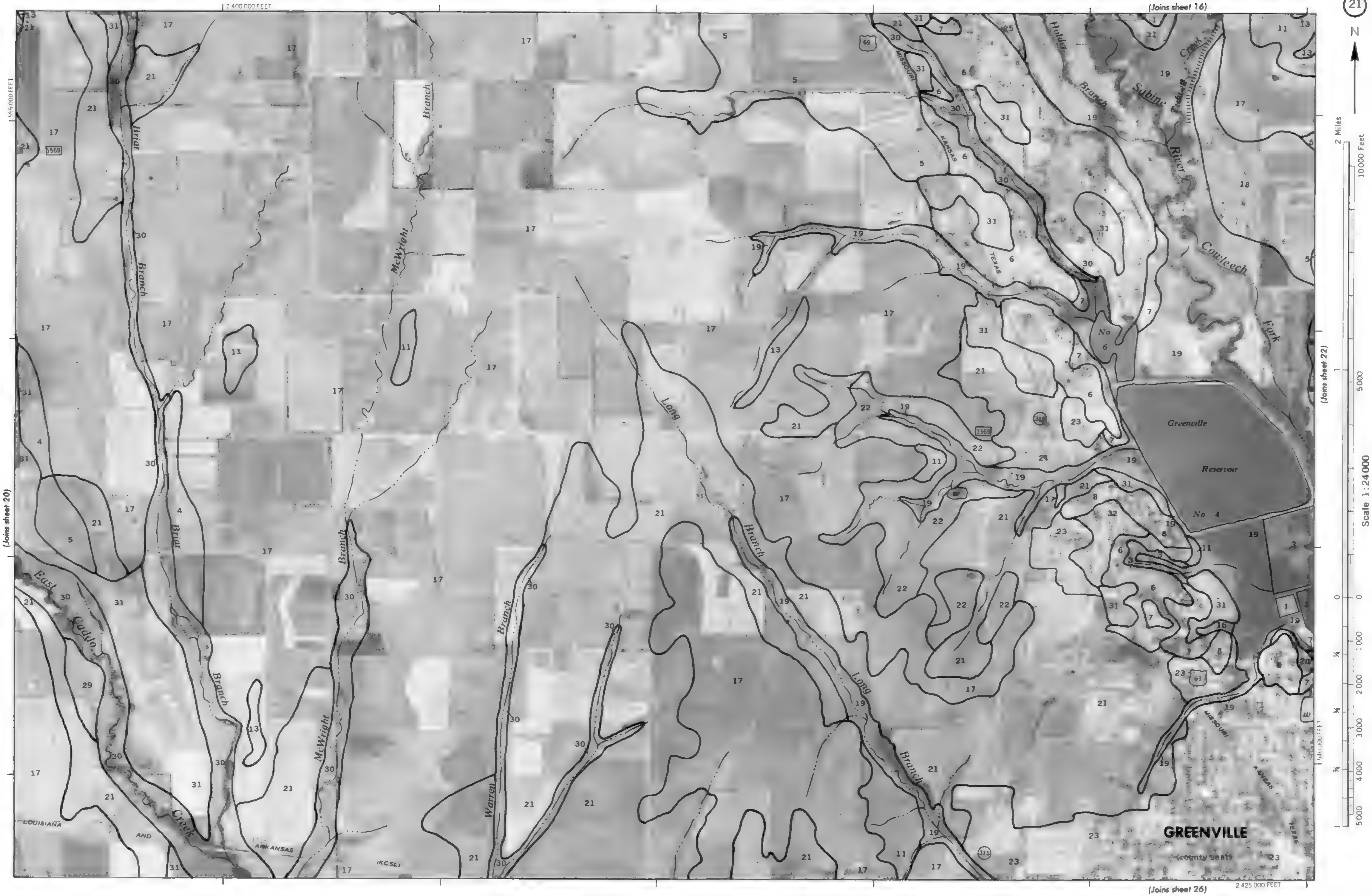

16
N
(Joins sheet 11)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 21)
2 Miles
10 000 Feet
5000
Scale 1:24 000
2 425 000 FEET
575 000 FEET
560 000 FEET
2 400 000 FEET
Cowleech Creek
Cowleech Fork
Hickory Creek
Sabine River
Hickory Creek
Cowleech Fork
Branch
Muriel
McWright Branch
Holder Branch
Holder Branch
Tidwell Creek
Briar Branch
Kellogg
MISSOURI
KANSAS
TEXAS
69
2194


17
(Joins sheet 12)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 22)
Brushy Creek
Horse Creek
Wolf Creek
Little Wolf Creek
Foster Creek
South Sulphur River
Jacobia Community
Concord Community
Neylandville
2 450 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet
N


N
(Joins sheet 13)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 23)
Scale 1:24000
2 Miles
10 000 Feet
2 480 000 FEET
575 000 FEET
560 000 FEET
2 455 000 FEET
Neylandville
Rays Creek
South Sulphur River
(Old River Channel)
ST LOUIS
SOUTH
WESTERN
2874

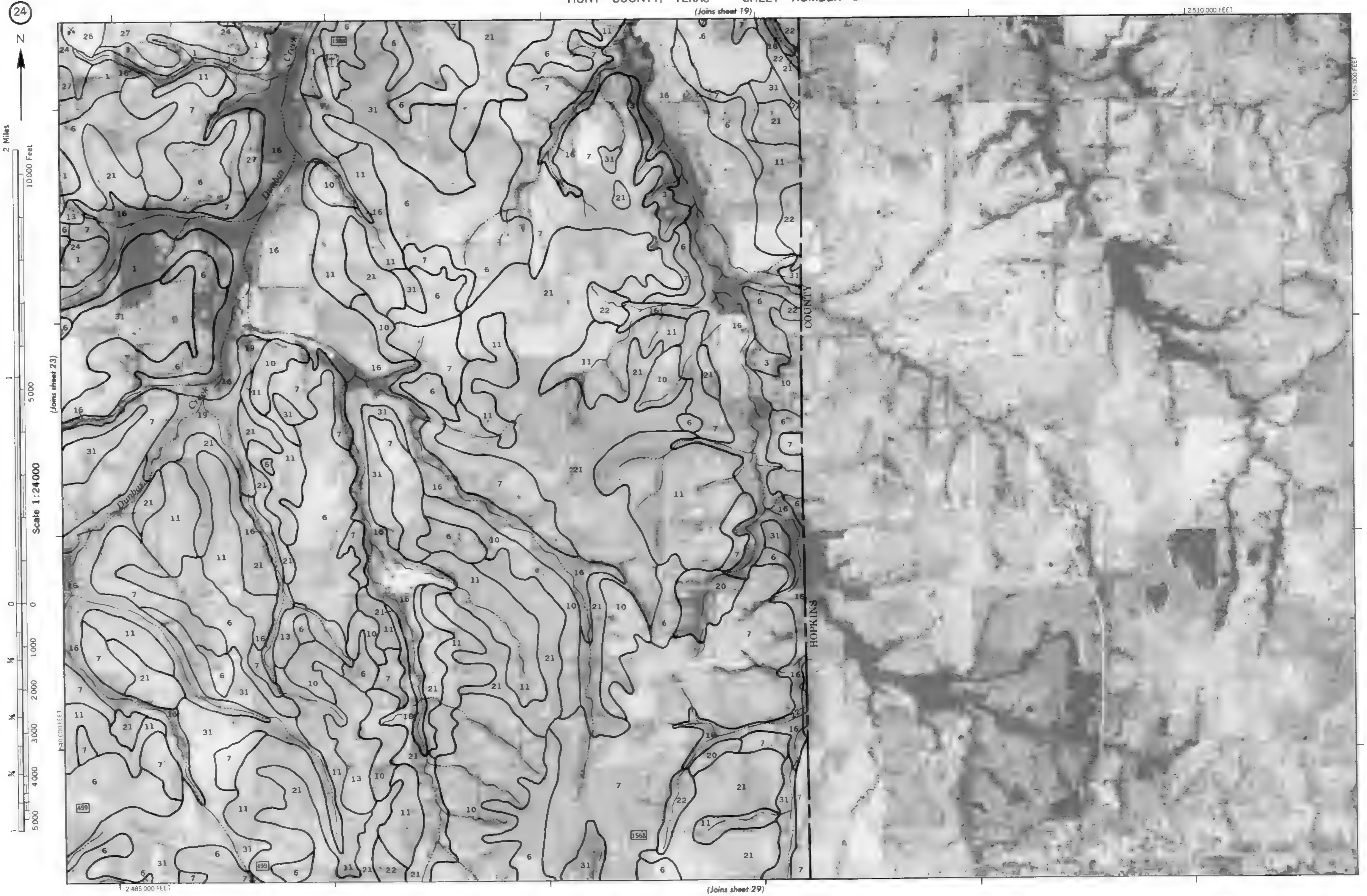

19
(Joins sheet 14)
(Joins sheet 18)
(Joins sheet 24)
EAST TEXAS
STATE COLLEGE
COMMERCE
Roundhouse Pool
water
SEWAGE
DISPOSAL
PONDS
South Sulphur River
Dunbar Creek
SOUTHWESTERN
ST LOUIS
DELTA COUNTY
HOPKINS COUNTY
575 000 FEET
2 510 000 FEET
N
2 Miles
10 000 Feet
Scale 1:24000

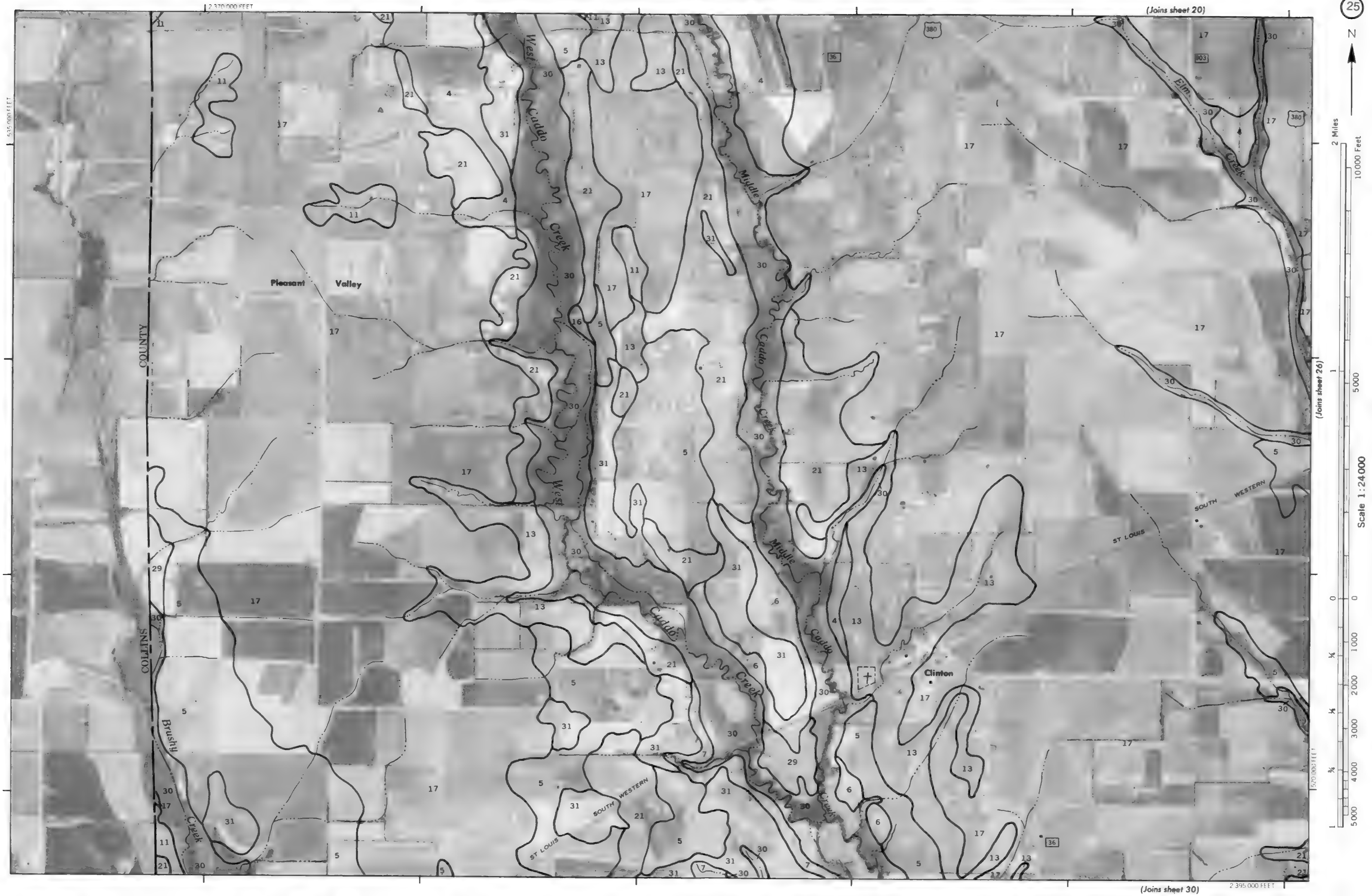

20
N
(Joins sheet 15)
(Joins sheet 25)
(Joins sheet 21)
2 395 000 FEET
2 370 000 FEET
Scale 1:24000
2 Miles
10 000 Feet
COLLIN
COUNTY
West Caddo Creek
Clemburg
Middle Caddo Creek
East Caddo Creek
Elm Creek
Wagner Community
Floyd
LOUISIANA AND ARKANSAS (KCSL)
903
36
380
1569

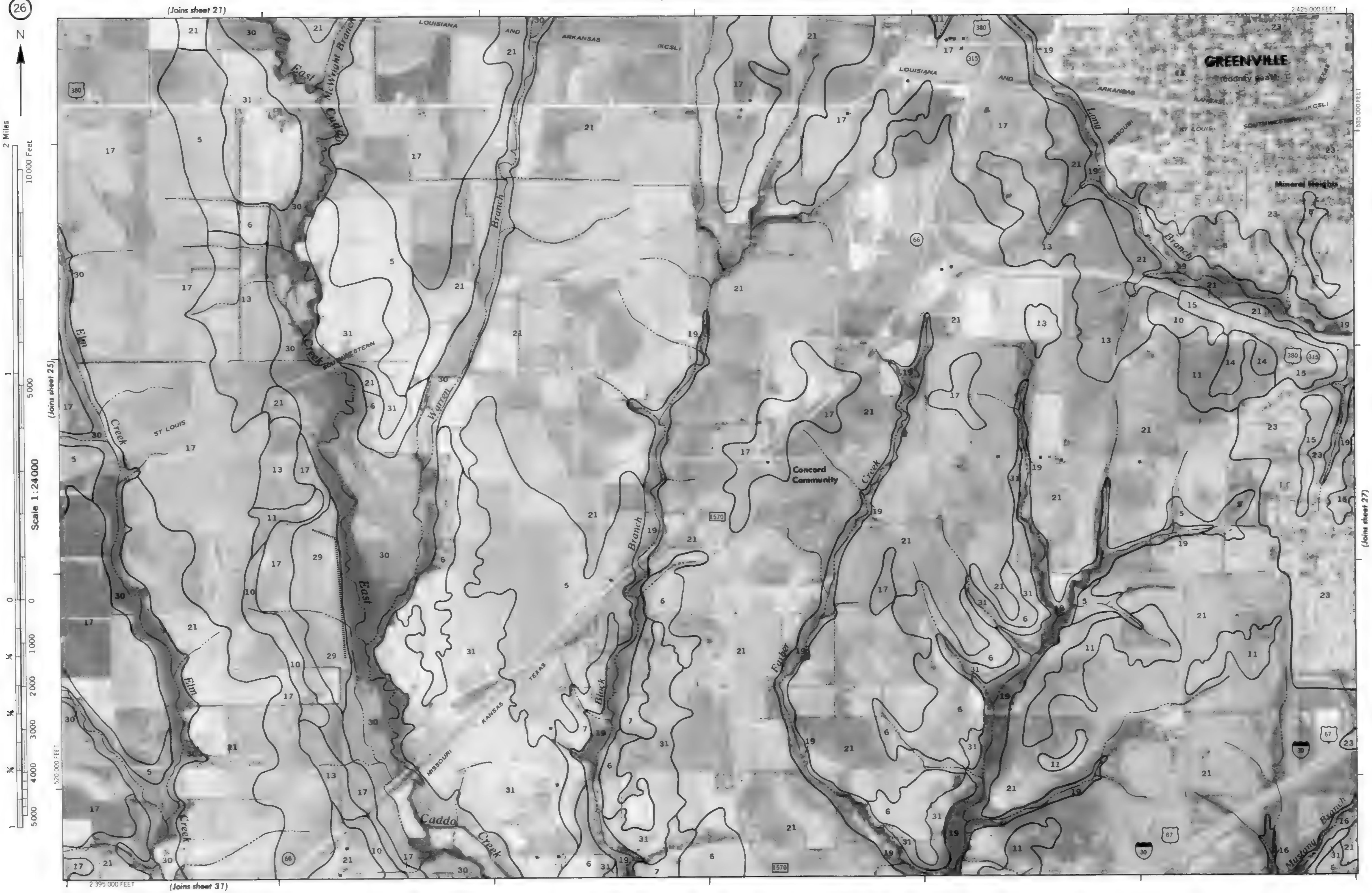

21
N
(Joins sheet 16)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 26)
2 400 000 FEET
2 425 000 FEET
155 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet
Briar Branch
McWright Branch
Long Branch
Warren Branch
East Caddo Creek
Holder Branch
Sabine River
Cowleech Fork
Greenville Reservoir No 4
Greenville Reservoir No 6
GREENVILLE
(county seat)
LOUISIANA AND ARKANSAS (KCSL)
MISSOURI KANSAS TEXAS

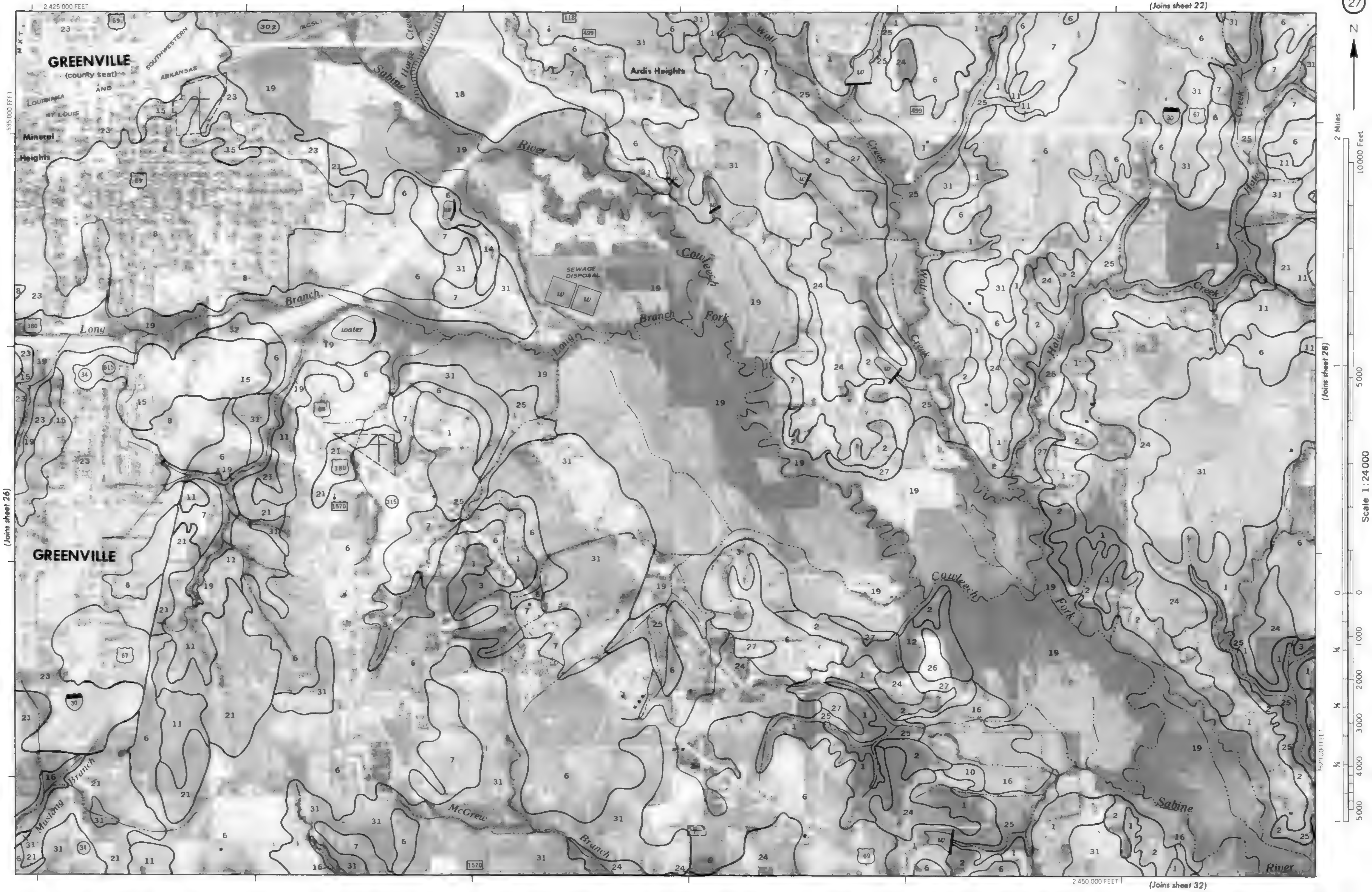

22
N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 17)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 27)
2 450 000 FEET
2 425 000 FEET
Greenville Reservoir No 5
Reservoir
water
Cowleech Fork
Sabine River
Brushy Creek
Horse Creek
Wolf Creek
Little Wolf Creek
Hale Creek
ST LOUIS SOUTHWESTERN
LOUISIANA AND ARKANSAS (KCSL)
GREENVILLE
(county seat)
Ardis Heights


23
(Joins sheet 18)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 28)
2 455 000 FEET
2 480 000 FEET
N
LOUISIANA AND ARKANSAS (KCS)
Watson Branch
West Timber Creek
Caney Creek
Dunbar Creek
Campbell
2736
499
513
50
2 Miles
10000 Feet
Scale 1:24000

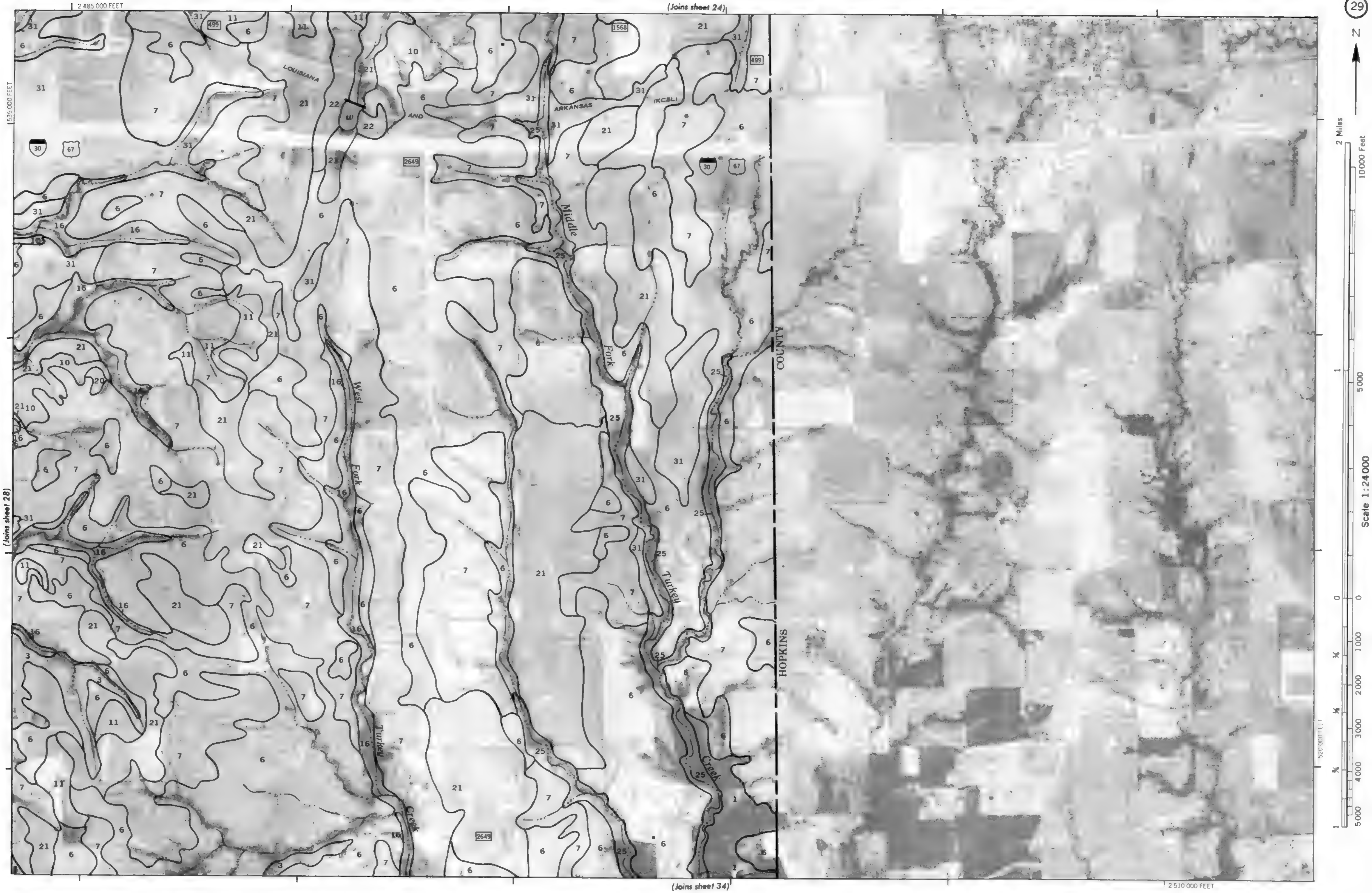

24
N
(Joins sheet 19)
2 510 000 FEET
555 000 FEET
(Joins sheet 23)
(Joins sheet 29)
2 485 000 FEET
540 000 FEET
Dunbar Creek
Creek
Dunbar
HOPKINS COUNTY
1568
499
2 Miles
10 000 Feet
5 000
Scale 1:24 000
0
1000
2000
3000
4000
5 000

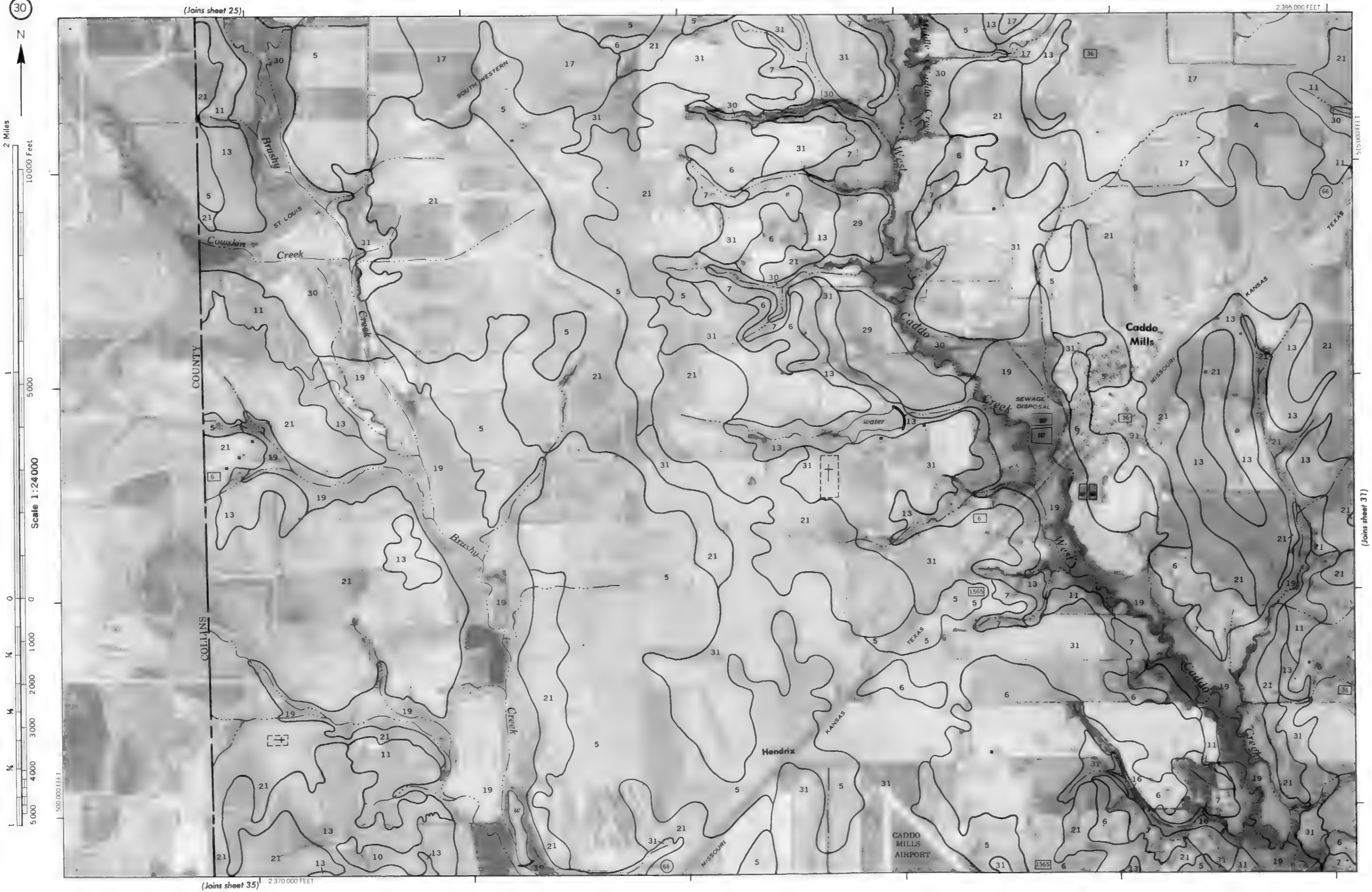

25
N
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 30)
2 370 000 FEET
2 395 000 FEET
535 000 FEET
520 000 FEET
COLLINS COUNTY
Pleasant Valley
Clinton
West Caddo Creek
Middle Caddo Creek
Caddo Creek
Elm Creek
Brushy Creek
ST LOUIS SOUTH WESTERN
380
36
903
Scale 1:24 000
2 Miles
10 000 Feet
1
5000
0
0
½
1000
2000
3000
4000
5000


26
N
(Joins sheet 21)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 31)
Scale 1:24000
2 Miles
10 000 Feet
GREENVILLE
(county seat)
Mineral Heights
Concord Community
LOUISIANA AND ARKANSAS (KCSL)
MISSOURI KANSAS TEXAS
ST LOUIS SOUTHWESTERN
East Caddo Creek
McWright Branch
Warren Branch
Elm Creek
Block Branch
Father Creek
Long Branch
Mustang Branch
Caddo Creek
2 425 000 FEET
2 395 000 FEET
535 000 FEET
520 000 FEET

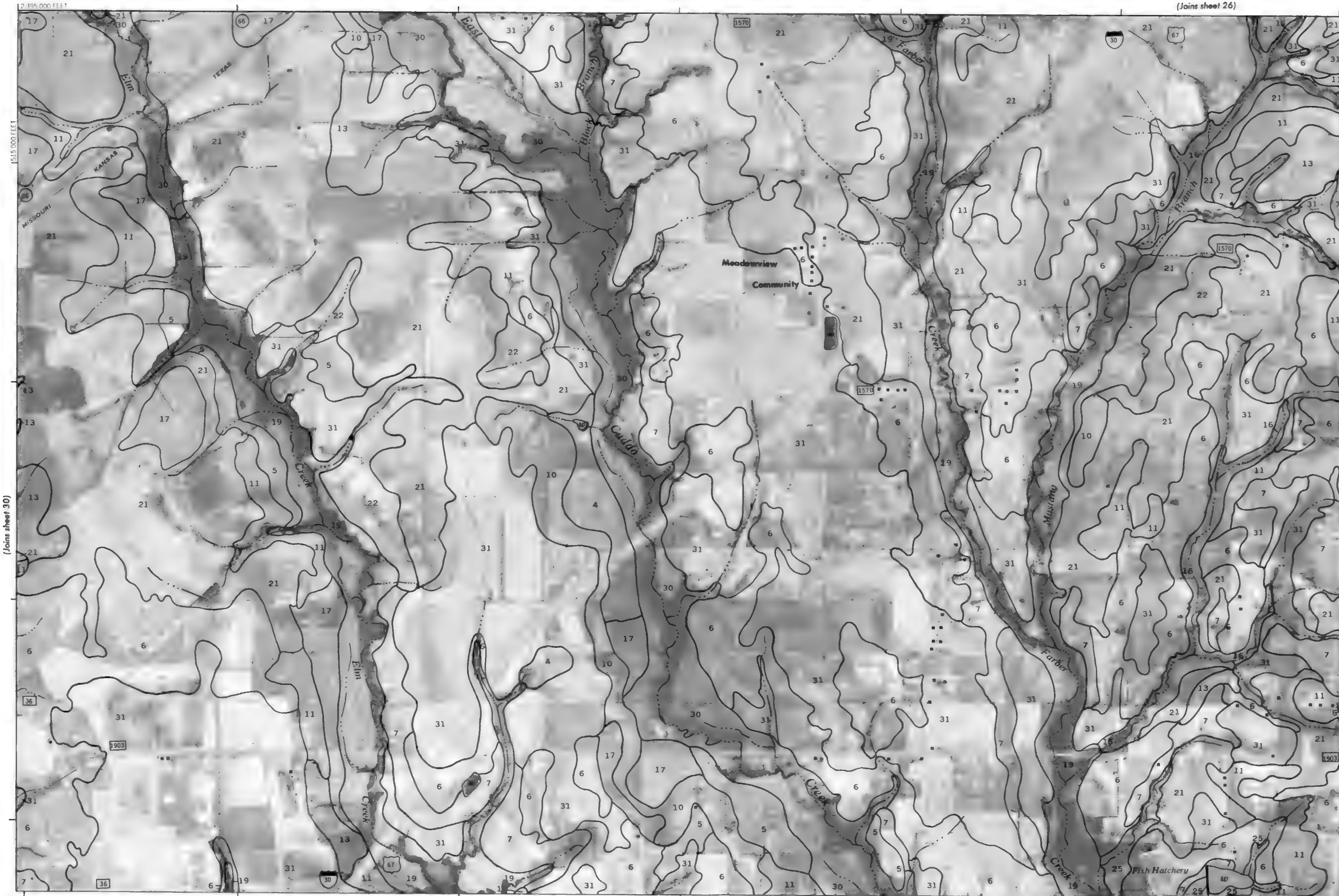

2 425 000 FEET
(Joins sheet 22)
GREENVILLE
(county seat)
LOUISIANA
AND
ST LOUIS
SOUTHWESTERN
ARKANSAS
M K T
(KCSL)
Mineral
Heights
Ardis Heights
Sabine
Horse
Creek
River
Cowleech
Fork
Wolf
Creek
Hale
Creek
SEWAGE
DISPOSAL
w
water
Long
Branch
(Joins sheet 28)
(Joins sheet 26)
GREENVILLE
Cowleech
Fork
Sabine
River
McGrew
Branch
Mustang
Branch
2 450 000 FEET
(Joins sheet 32)
N
2 Miles
1
0
10 000 Feet
5000
0
Scale 1:24 000

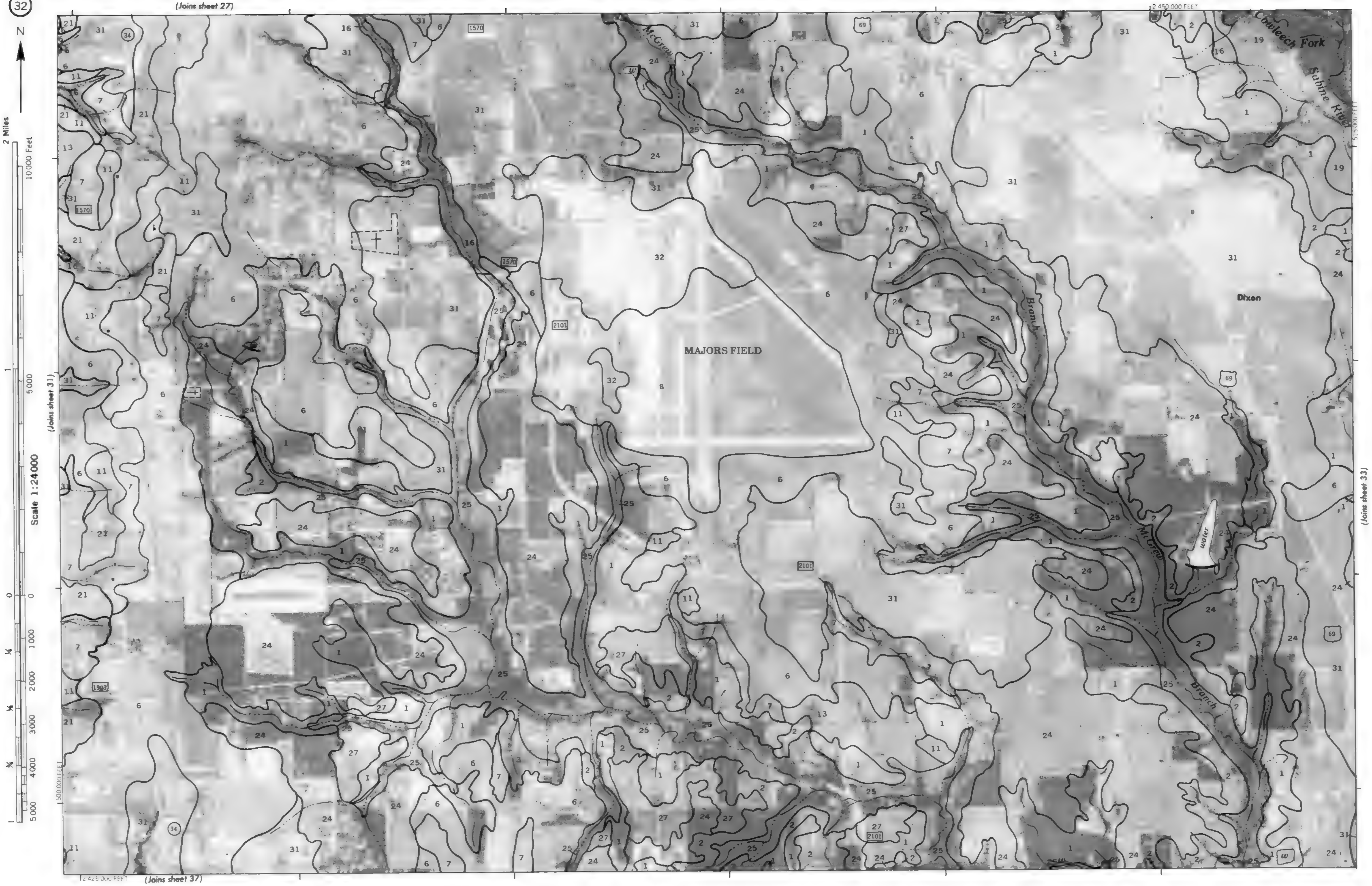

(Joins sheet 23)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 33)
N
Scale 1:24000
2 Miles
10000 Feet
5000
1000
2000
3000
4000
5000
2 480 000 FEET
2 455 000 FEET
Watson Branch
Lynn Creek
Timber Creek
West Caney Creek
Caney Creek
Head Creek

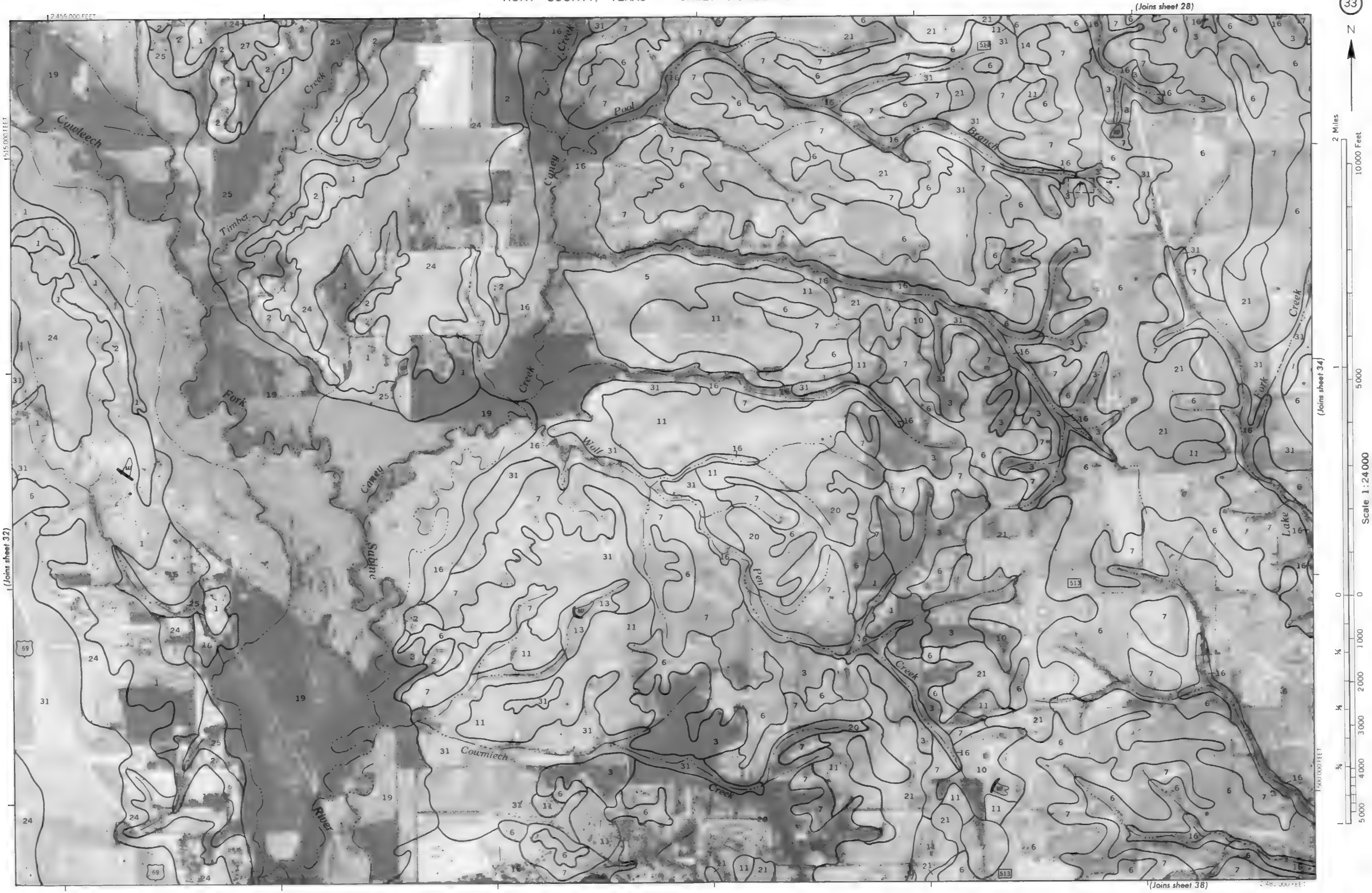

29
2 485 000 FEET
(Joins sheet 24)
(Joins sheet 28)
(Joins sheet 34)
2 510 000 FEET
535 000 FEET
520 000 FEET
LOUISIANA
AND
ARKANSAS
(KCSL)
Middle Fork
West Fork
Turkey Creek
HOPKINS
COUNTY
N
2 Miles
10000 Feet
5000
Scale 1:24000



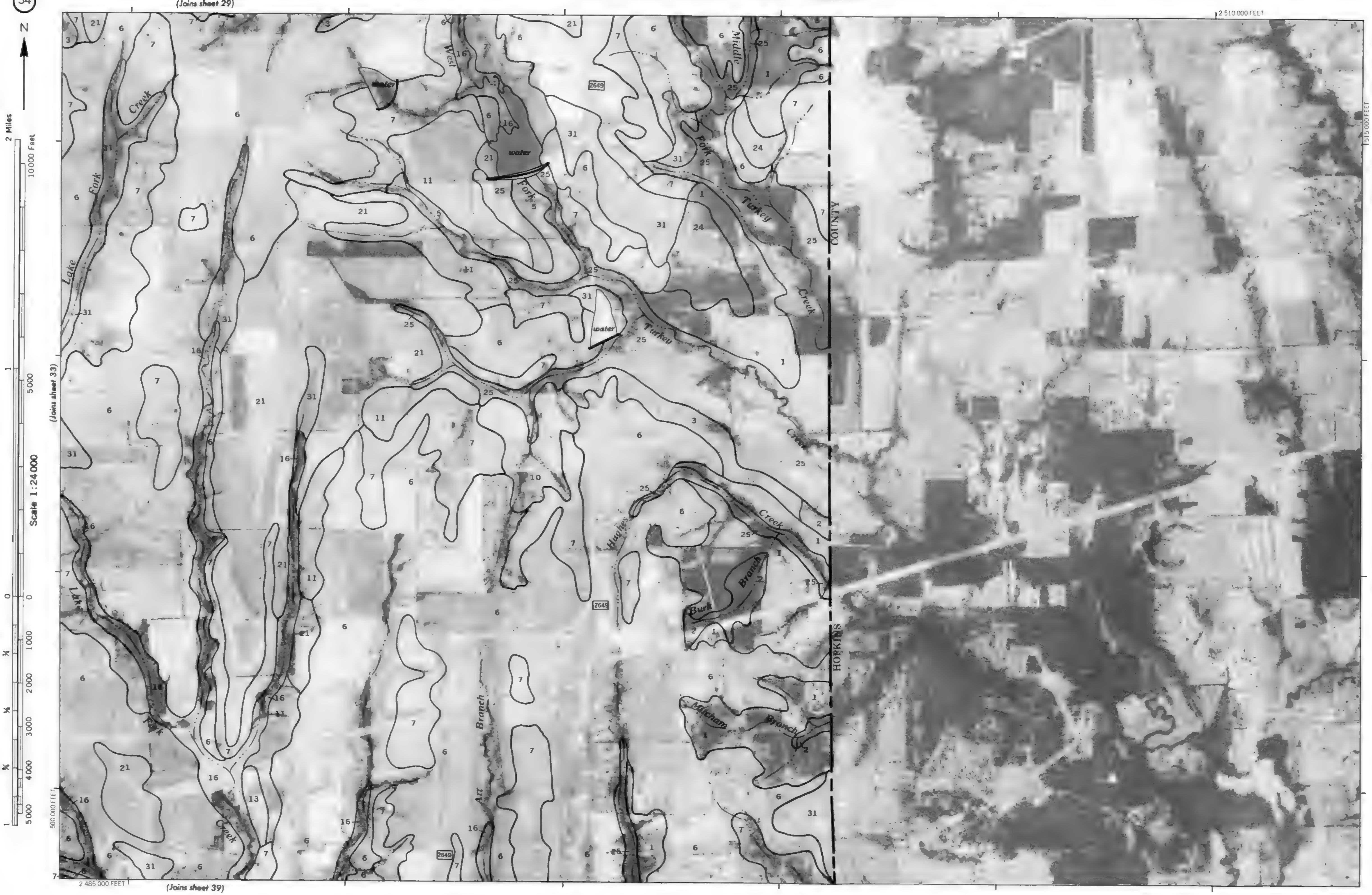
30
N
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 35)
2 395 000 FEET
2 370 000 FEET
515 000 FEET
500 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet
COLLINS COUNTY
Brushy Creek
Cowskin Creek
ST LOUIS
SOUTH WESTERN
Middle Caddo Creek
West Caddo Creek
Caddo Creek
Caddo Mills
SEWAGE DISPOSAL
water
MISSOURI
KANSAS
TEXAS
Hendrix
CADDO MILLS AIRPORT
36
66
6
1565

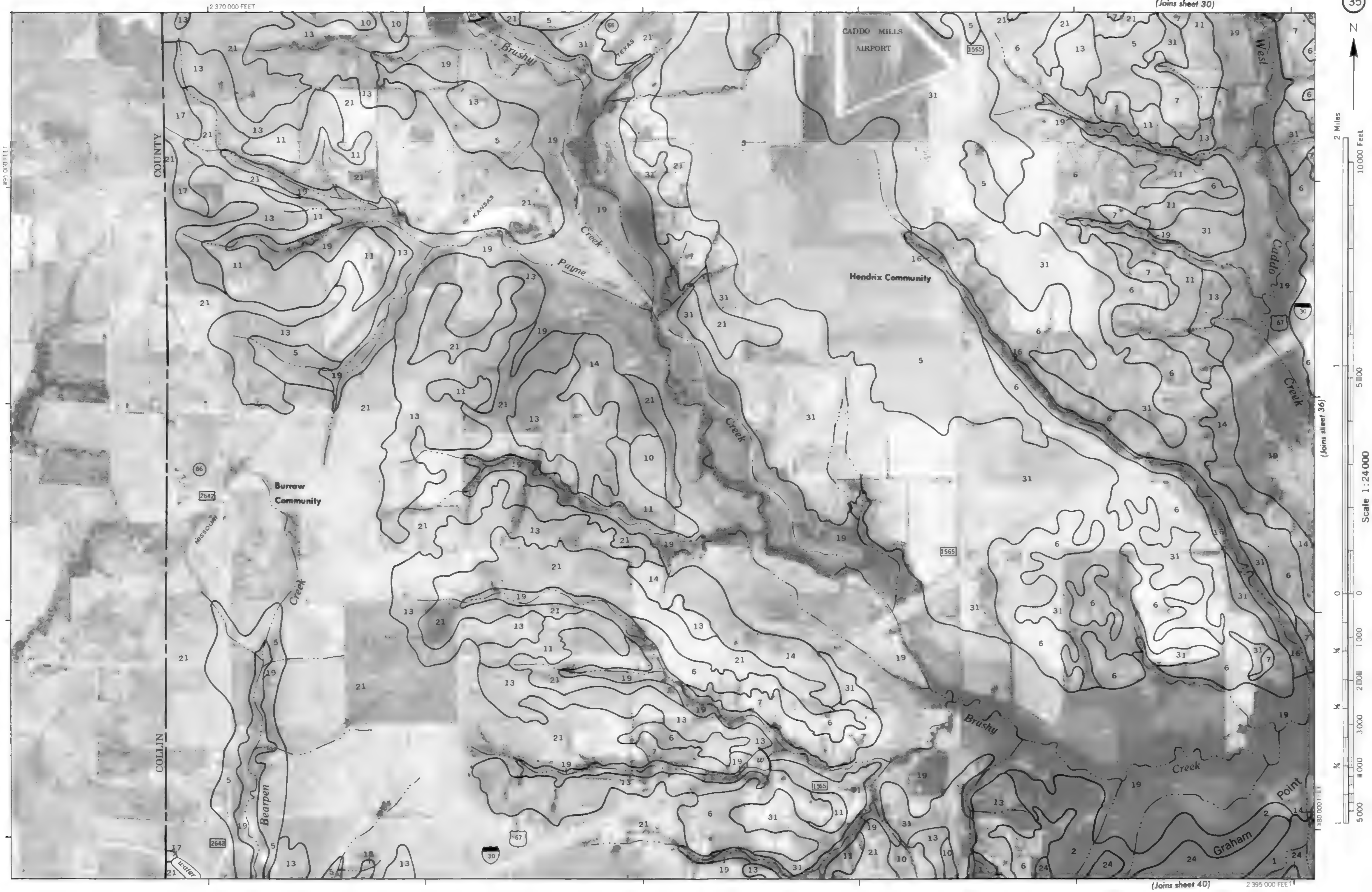

(Joins sheet 26)
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 36)
Meadowview Community
Fish Hatchery
Elm Creek
East Caddo Creek
Block Branch
Farber Creek
Mustang Creek
Branch
MISSOURI KANSAS TEXAS
2 395 000 FEET
515 000 FEET
400 000 FEET
2 425 000 FEET
N
Scale 1:24000
2 Miles
1
0
¾
½
¼
1
10000 Feet
5000
0
1000
2000
3000
4000
5000

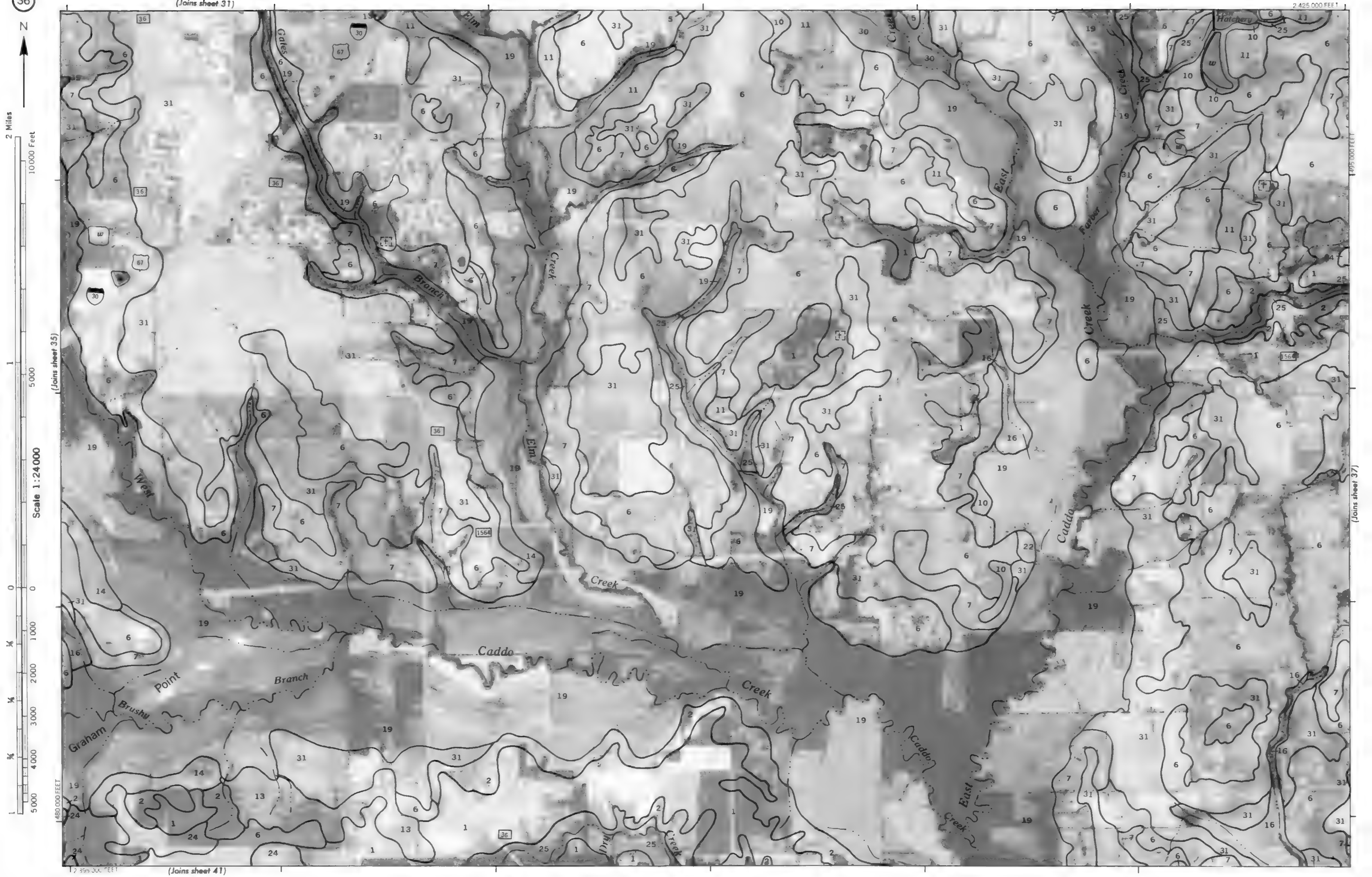

N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 27)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 37)
2 450 000 FEET
2 425 000 FEET
MAJORS FIELD
Dixon
McCrew Branch
Cowleech Fork
Sabine River
water

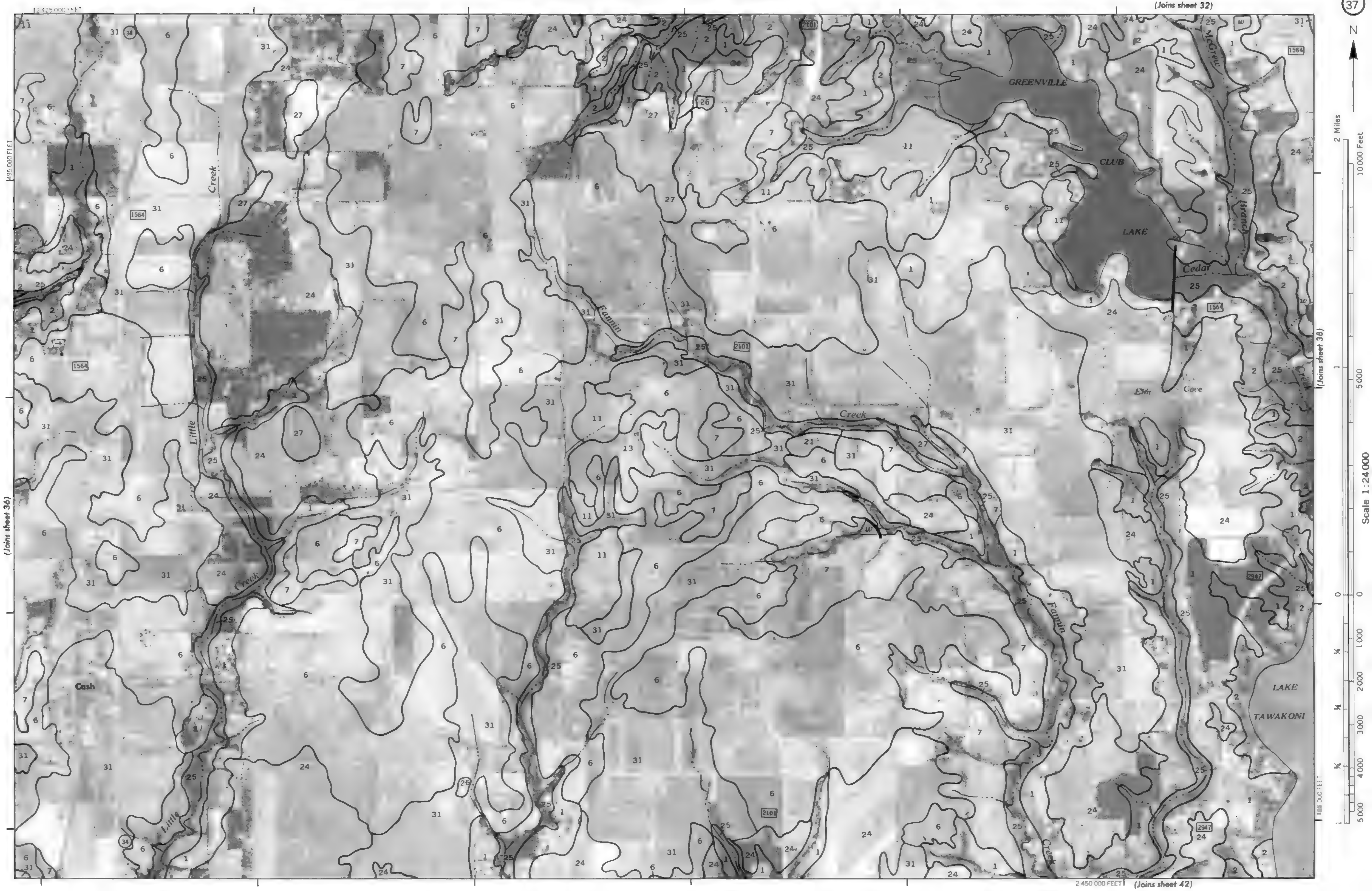

(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 38)
(Joins sheet 32)
2 455 000 FEET
1 515 000 FEET
N
2 Miles
10000 Feet
Scale 1:24 000
Cowleech
Timber Creek
Caney Creek
Pool
Branch
Fork
Sabine River
Wolf
Pen
Creek
Cowleech Creek
Lake Fork Creek

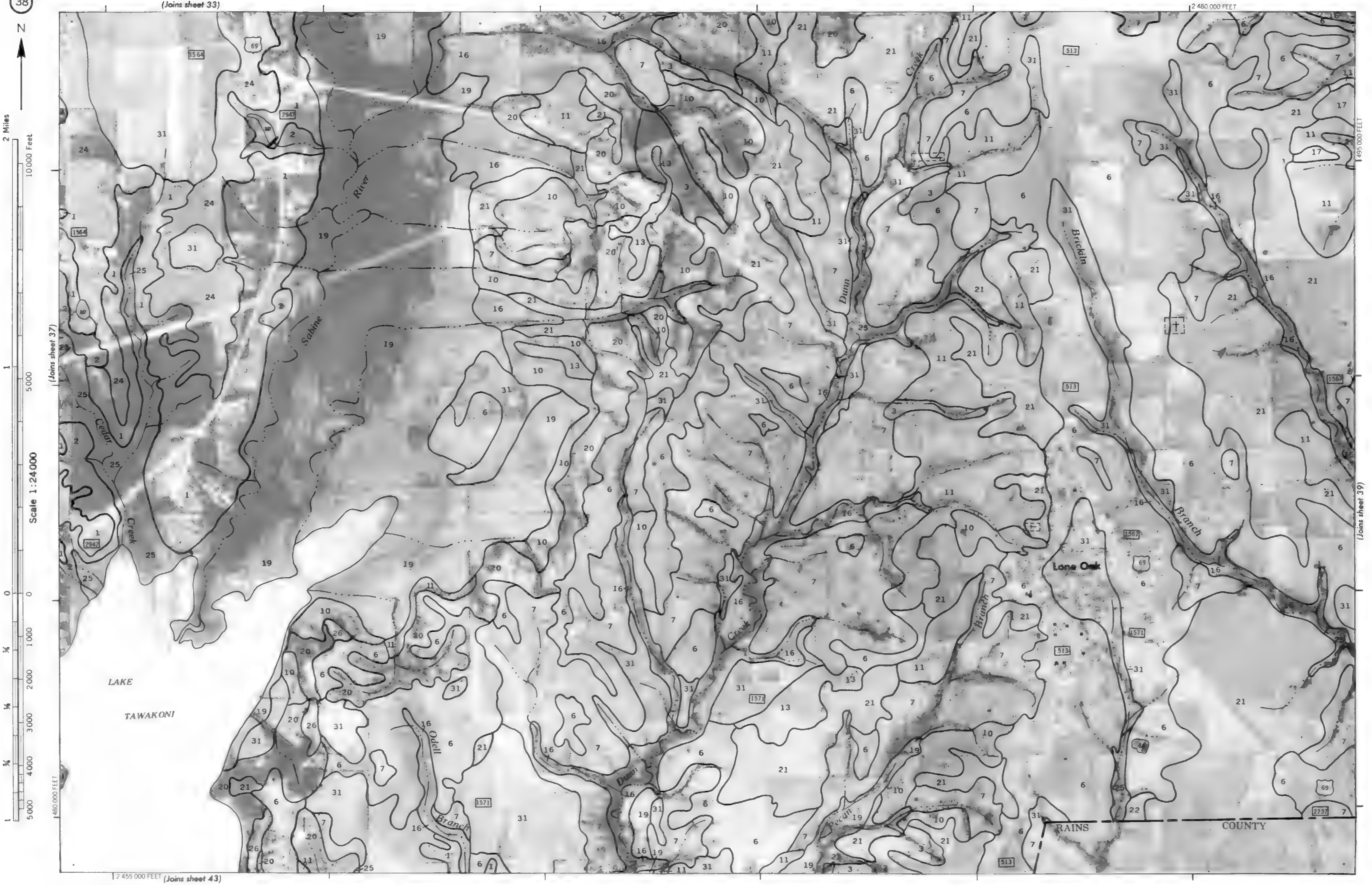
HUNT COUNTY, TEXAS — SHEET NUMBER 34

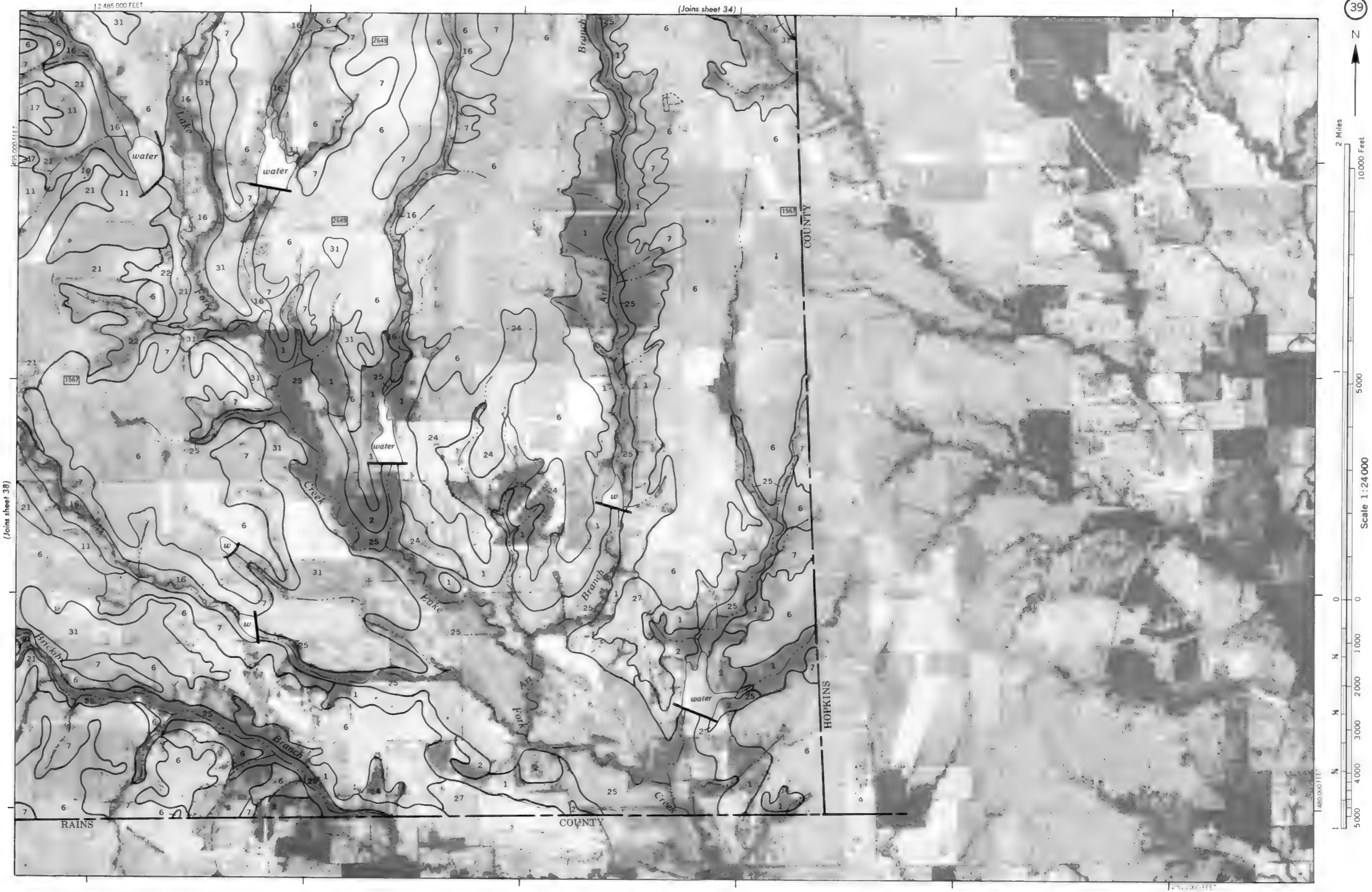



35
(Joins sheet 30)
(Joins sheet 36)
(Joins sheet 40)
CADDO MILLS AIRPORT
Hendrix Community
Burrow Community
COLLIN COUNTY
Brushy Creek
Payne Creek
West Caddo Creek
Bearpen Creek
Graham Point
2 370 000 FEET
2 395 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet


(Joins sheet 31)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 41)
N
2 Miles
10 000 Feet
Scale 1:24 000
2 425 000 FEET
495 000 FEET
480 000 FEET
Gates
Branch
Elm
Creek
East
Farber
Creek
Hatchery
West
Caddo
Creek
Brushy
Point
Branch
Graham
Caddo
East
Creek
Dry
Creek


(Joins sheet 32)
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 42)
2 425 000 FEET
495 000 FEET
2 450 000 FEET
GREENVILLE CLUB LAKE
LAKE TAWAKONI
Cedar Creek
McGrew Branch
Elm Cove
Fannin Creek
Little Creek
Cash
N
Scale 1:24 000
2 Miles
10000 Feet


(Joins sheet 33)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 43)
N
2 Miles
10 000 Feet
5000
Scale 1:24000
2 480 000 FEET
2 455 000 FEET
495 000 FEET
480 000 FEET
Sabine River
Cedar Creek
Dunn Creek
Brickin Branch
Odell Branch
Pecan Creek
Lone Oak
LAKE TAWAKONI
RAINS COUNTY


39
2 485 000 FEET
(Joins sheet 34)
(Joins sheet 38)
water
Lake Fork
Lake Creek
Arr Fork
Arr Branch
Brickh Branch
RAINS
COUNTY
HOPKINS
COUNTY
N
2 Miles
10 000 Feet
Scale 1:24 000
480 000 FEET


40
N
(Joins sheet 35)
(Joins sheet 44)
(Joins sheet 41)
COLLIN COUNTY
ROCKWALL COUNTY
Bearpen
Creek
Bearpen
Creek
Graham
Point
Hurst
Creek
Sandy
Creek
Union Valley
Scale 1:24000
2 Miles
10 000 Feet
2 395 000 FEET
475 000 FEET
460 000 FEET
2 370 000 FEET


(Joins sheet 35)
(Joins sheet 42)
(Joins sheet 40)
(Joins sheet 46)
N
Scale 1:24 000
2 Miles
10 000 Feet
475 000 FEET
460 000 FEET
Dry Creek
Caddo Creek
Bois d'arc Creek
Sandy Creek


(Joins sheet 37)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 46)
N
2 Miles
10 000 Feet
5000
Scale 1:24 000
2 450 000 FEET
2 425 000 FEET
460 000 FEET
475 000 FEET
Little Creek
Little Creek
Caddo Creek
Cowleech Creek
LAKE TAWAKONI
LAKE TAWAKONI
water
2101
2947
34


(Joins sheet 38)
(Joins sheet 42)
(Joins sheet 47)
43
N
2 455 000 FEET
2 480 000 FEET
475 000 FEET
LAKE
TAWAKONI
Odell Branch
Dunn Creek
Hooker Ridge
Hooker
Branch
RAINS
COUNTY
1571
513
Scale 1:24 000
2 Miles
10 000 Feet

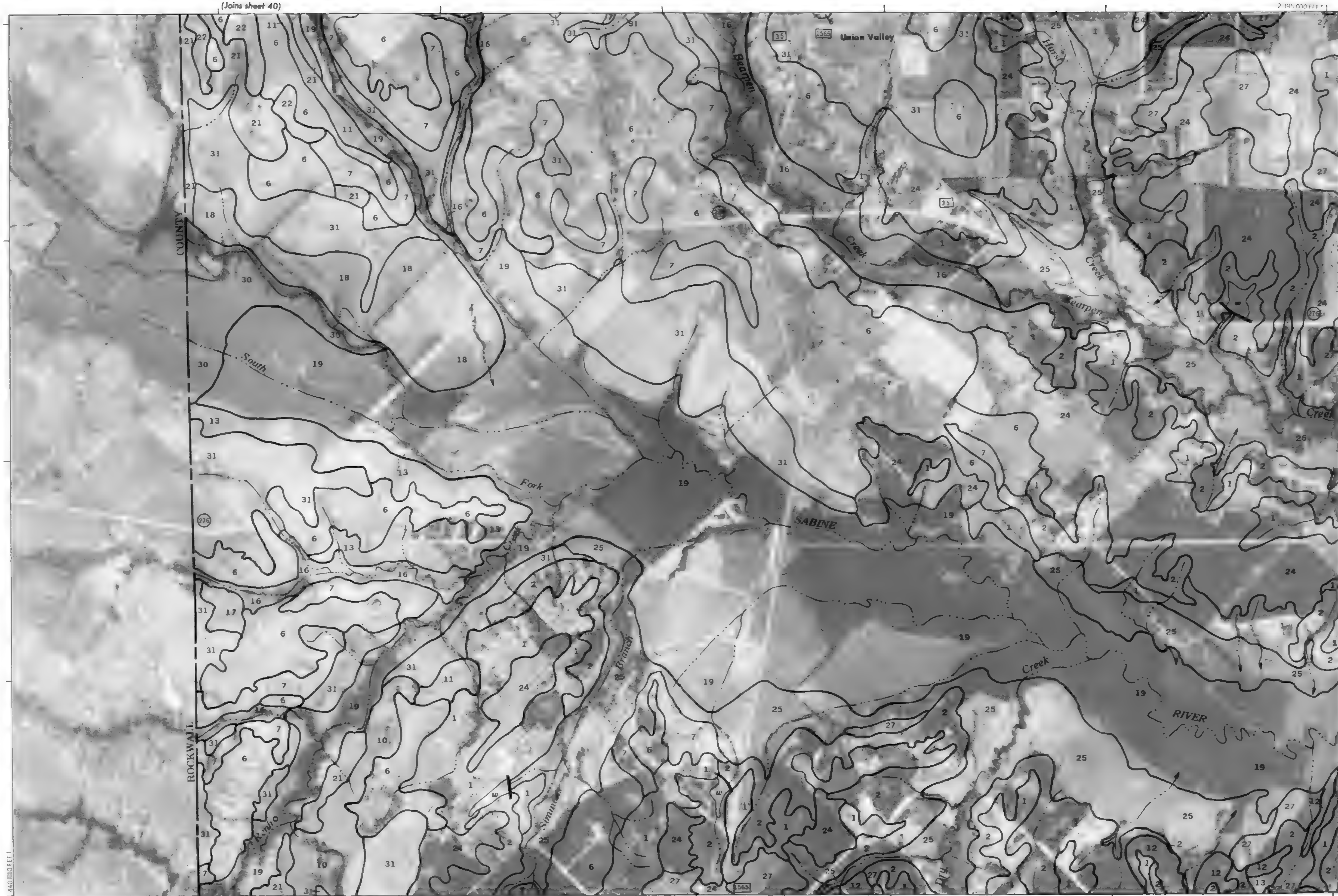
44

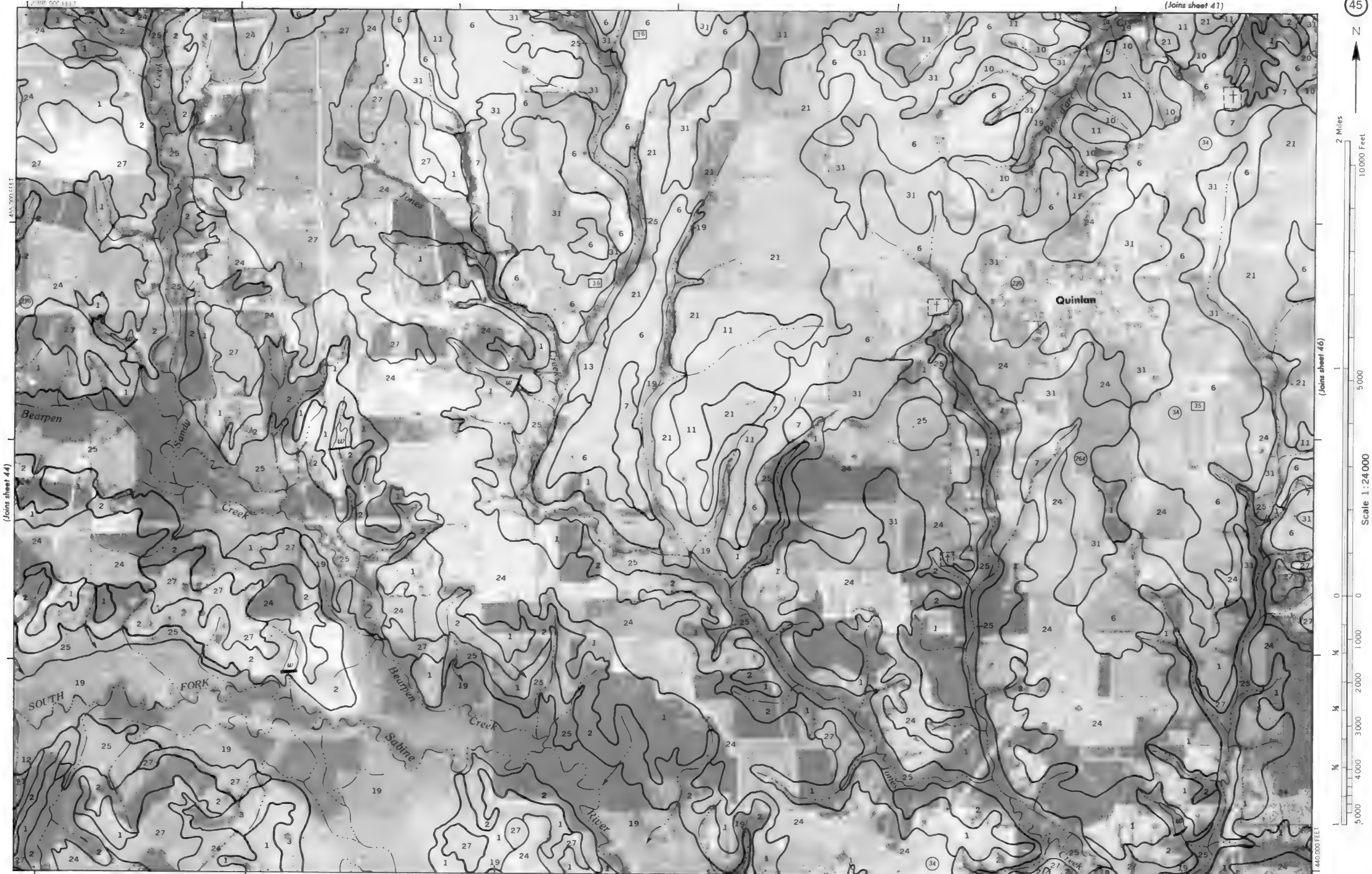
N

2 Miles

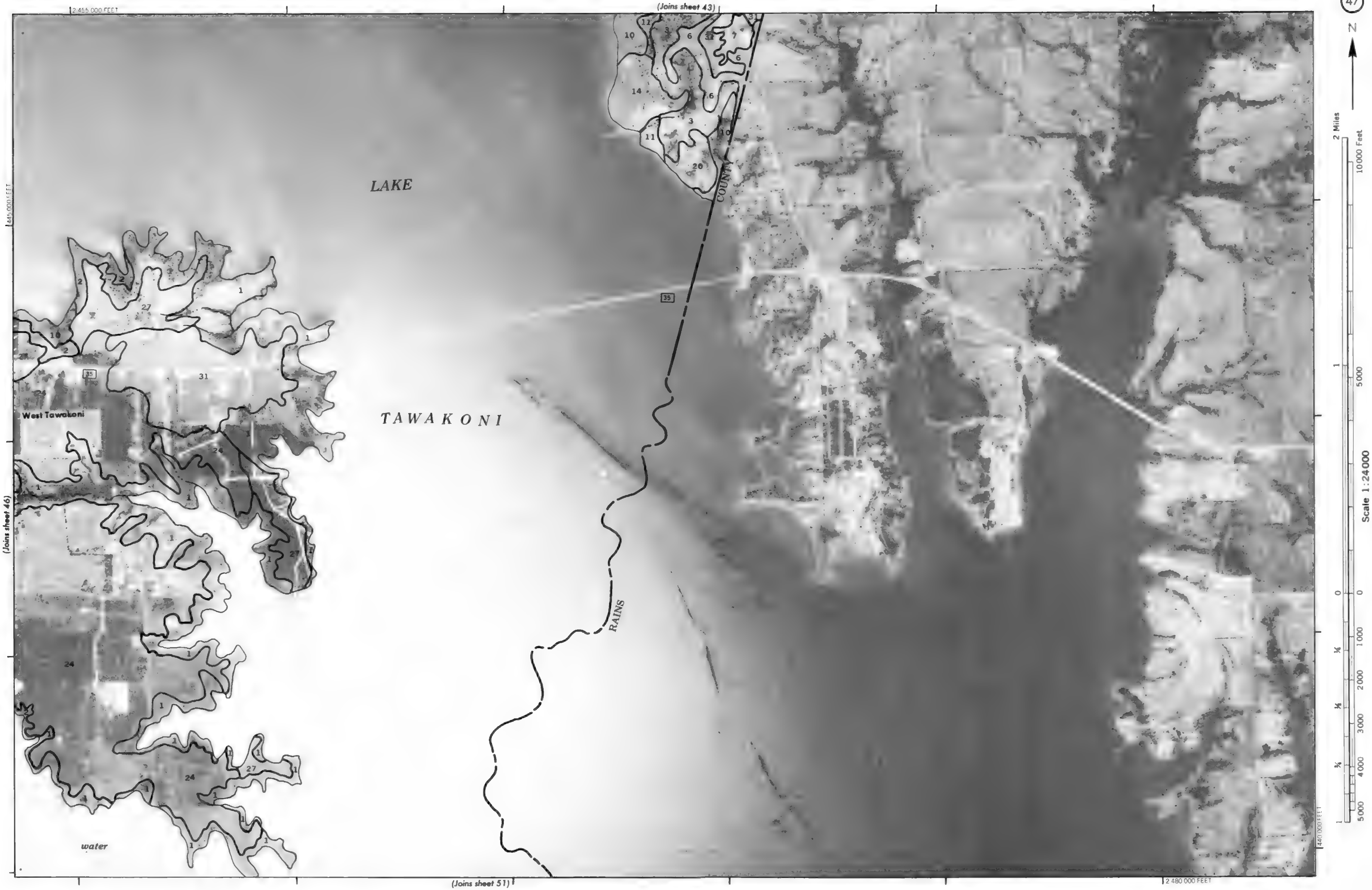
10 000 Feet

Scale 1:24 000

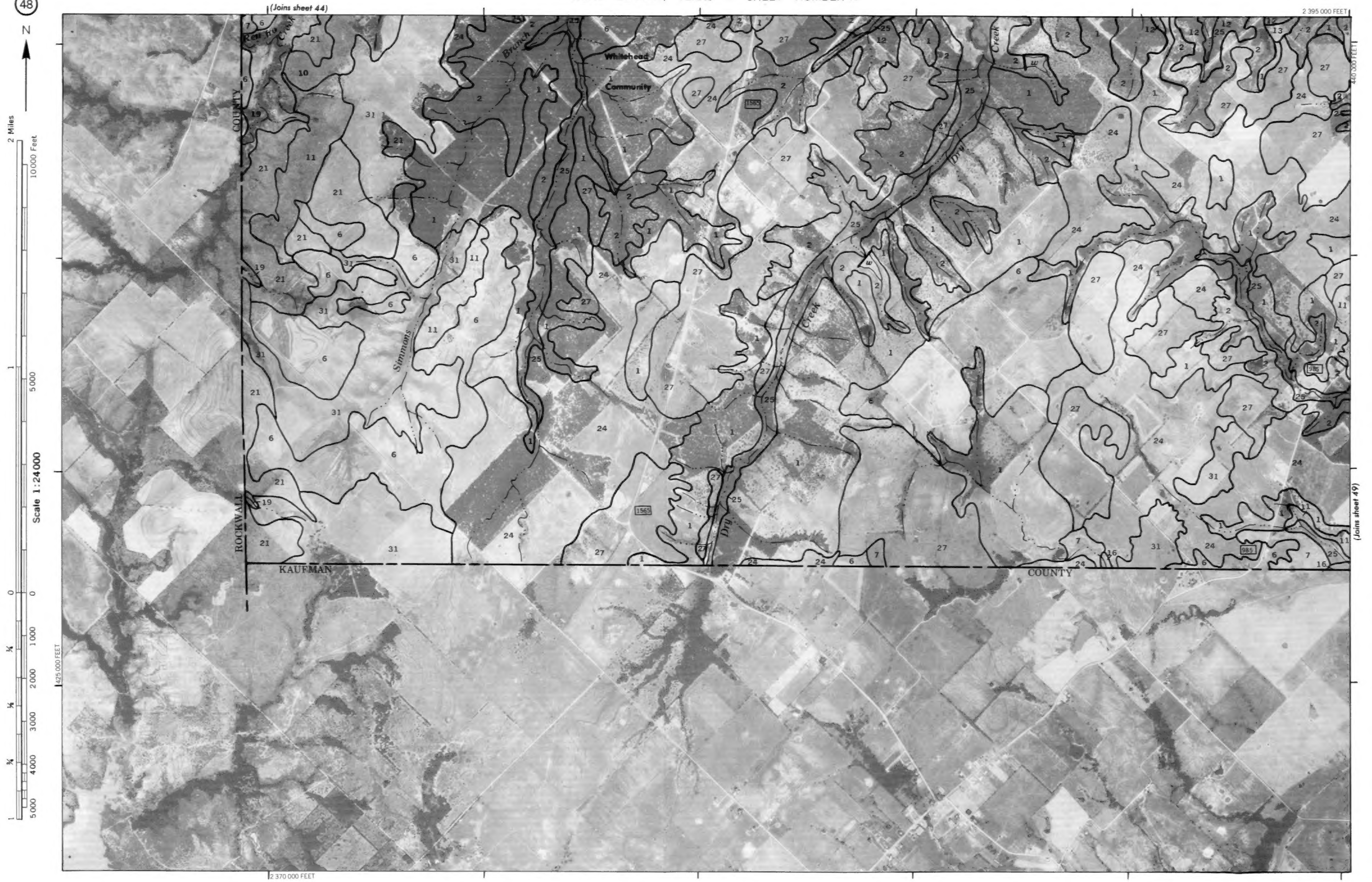


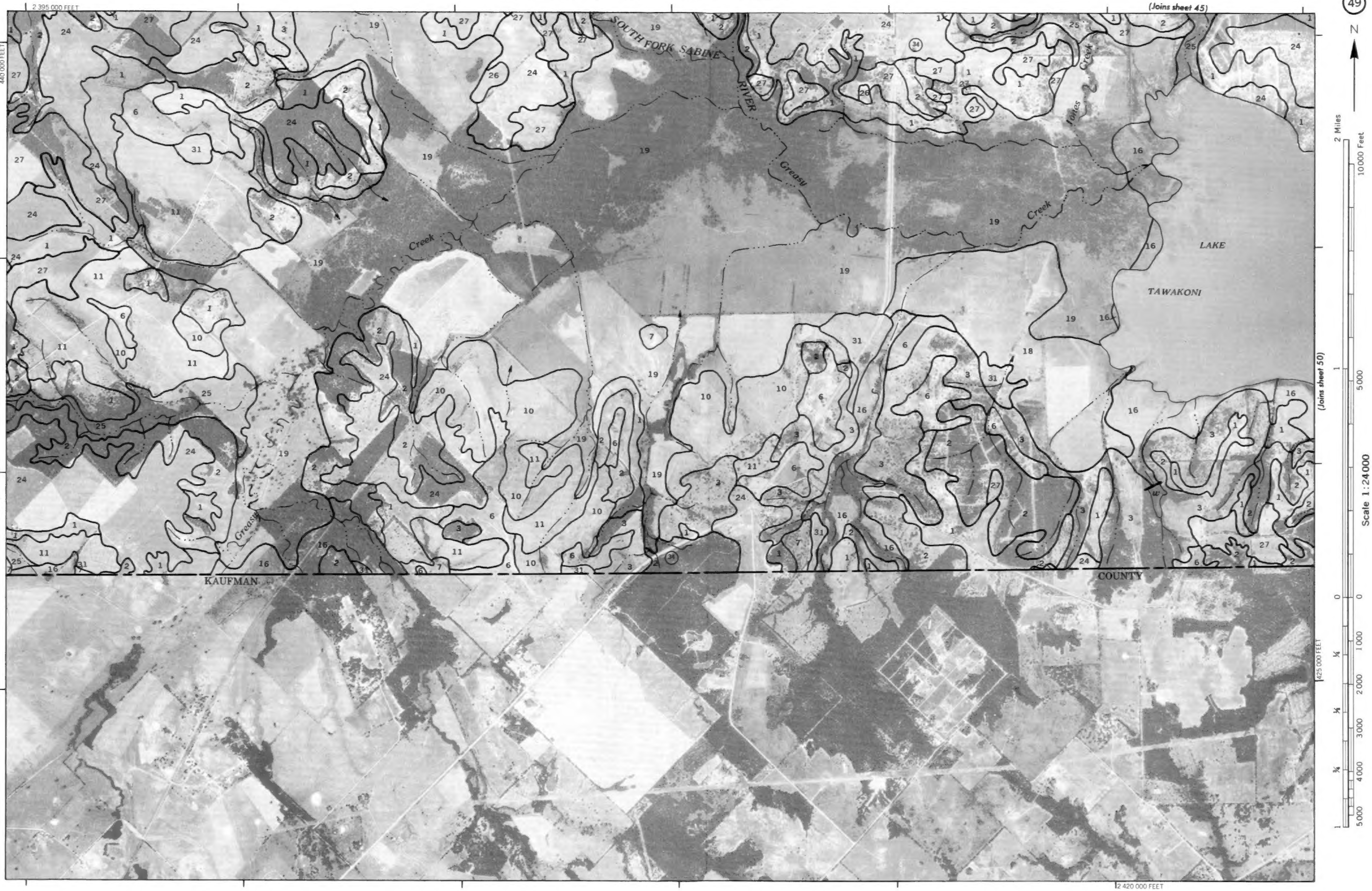

45
(Joins sheet 41)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 49)
Quinlan
Bearpen
Sandy
Creek
Jones
Creek
SOUTH
FORK
Sabine
River
Bearpen
Creek
Jones
Creek
N
2 Miles
10 000 Feet
Scale 1:24 000

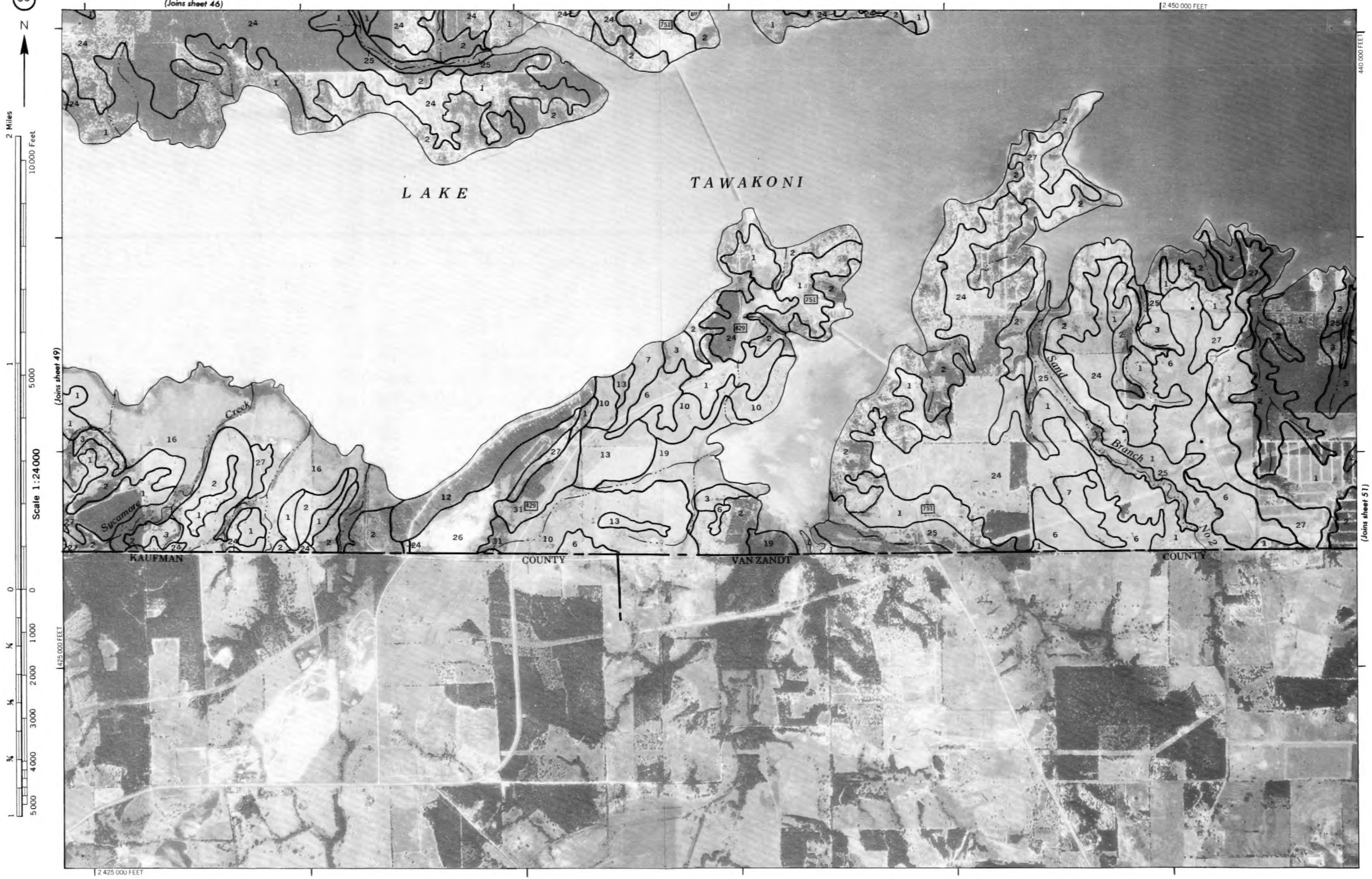

46
N
(Joins sheet 42)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 50)
LAKE
TAWAKONI
Mexico
West
Tawakoni
LAKE
TAWAKONI
water
water
35
751
2 450 000 FEET
455 000 FEET
440 000 FEET
2 425 000 FEET
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
1
¼
½
¾

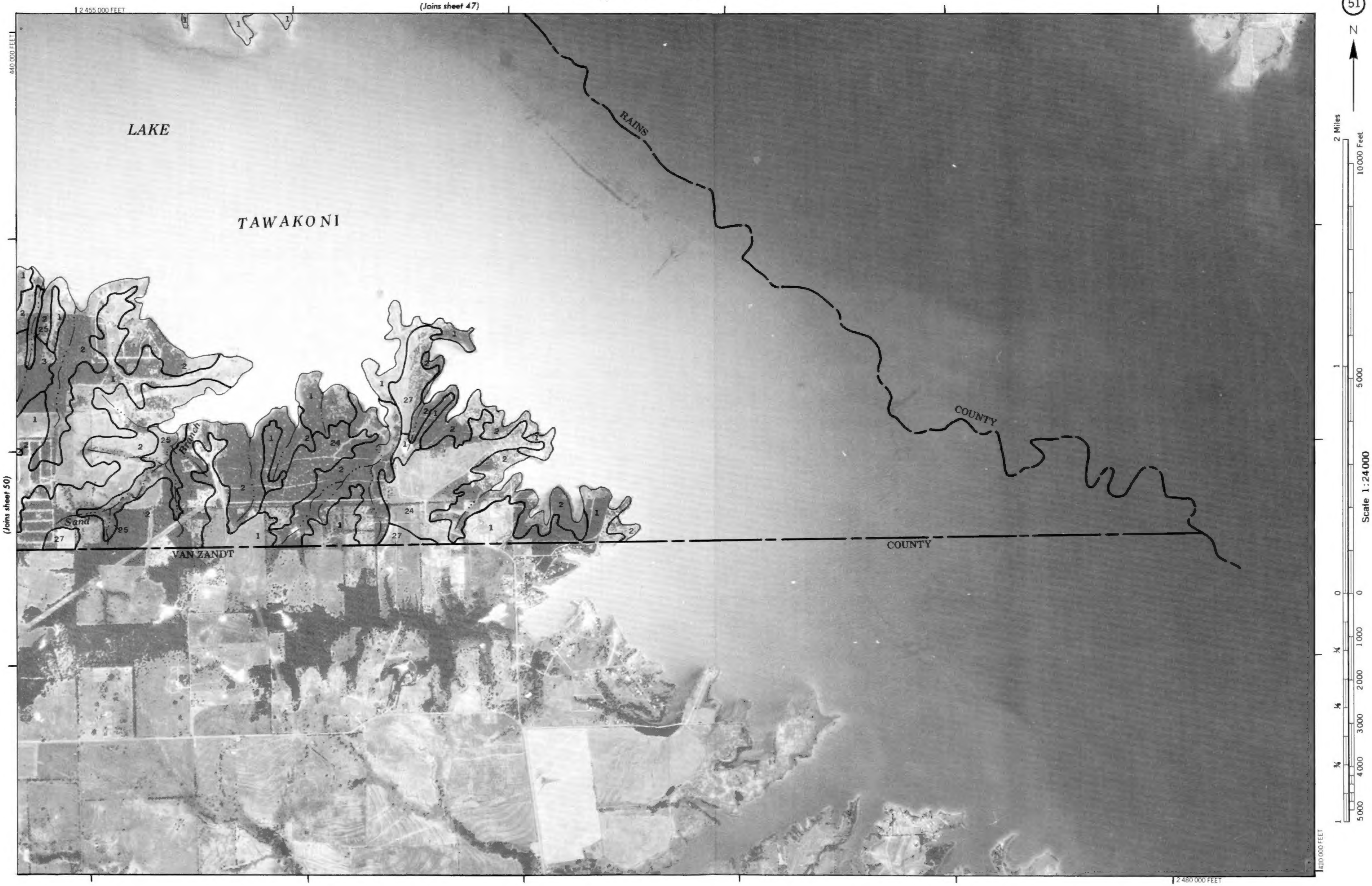

47
(Joins sheet 43)
(Joins sheet 46)
(Joins sheet 51)
2 455 000 FEET
445 000 FEET
440 000 FEET
2 480 000 FEET
LAKE
TAWAKONI
West Tawakoni
water
RAINS
COUNTY
35
N
2 Miles
10000 Feet
Scale 1:24000

HUNT COUNTY, TEXAS — SHEET NUMBER 48




2 395 000 FEET
440 000 FEET
(Joins sheet 45)
(Joins sheet 50)
(Joins sheet 48)
SOUTH FORK SABINE RIVER
Greasy Creek
Creek
Jones Creek
LAKE
TAWAKONI
KAUFMAN
COUNTY
425 000 FEET
2 420 000 FEET
N
2 Miles
10 000 Feet
Scale 1:24 000


(Joins sheet 46)
(Joins sheet 49)
(Joins sheet 51)
LAKE
TAWAKONI
Sycamore
Creek
Sand
Branch
No 2
KAUFMAN
COUNTY
VAN ZANDT
COUNTY
2 450 000 FEET
440 000 FEET
425 000 FEET
2 425 000 FEET
N
Scale 1:24000
2 Miles
10 000 Feet



51
(Joins sheet 47)
(Joins sheet 50)
2 455 000 FEET
440 000 FEET
400 000 FEET
2 480 000 FEET
LAKE
TAWAKONI
RAINS
COUNTY
VAN ZANDT
COUNTY
Sand
Branch
N
Scale 1:24 000
2 Miles
10 000 Feet
5000
0
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